Overview of knowledge transfer in MENA countries - The case of Egypt

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By Dr. Samia Satti Osman Mohamed Nour

(January 30, 2014)

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Abstract:

This paper provides an overview of knowledge transfer and explains the factors that enable or impede absorption capacity and knowledge transfer in the MENA countries, with particular reference to the case of Egypt. We employ the conceptual framework used in the international literature on absorption capacity and international knowledge transfer channels including FDI, international trade, ICT, education, human capital mobility and university-industry linkage, and we examine the factors that enable or impede absorption capacity and knowledge transfer channels in the MENA region and Egypt respectively. One interesting element in our study is that we present a systematic framework for the factors that enable or impede knowledge transfer in Egypt and the MENA region. We find that the factors hindering absorption capacity and knowledge transfer are related to institutions, infrastructure, macroeconomic environment, higher education and training, goods market efficiency and labour market efficiency, financial market development, technological readiness and capacity for innovation. Our results are consistent with the stylized facts in the MENA literature regarding the impediment factors hampering the transfer of knowledge in the MENA region. Our results are also in line with the stylized facts in the international literature regarding the interaction and linkage between the different knowledge transfer channels. The major policy implication from our findings is that knowledge transfer is facilitated by supporting the linkages between the different knowledge transfer channels within this systematic framework. Knowledge transfer through utilization of FDI is facilitated by the sound institutions for the provision of sufficiently qualified labour, ICT infrastructure, opening up to international trade, good university-industry cooperation, R&D and innovation capacity. Knowledge transfer through utilization of international trade is facilitated by the sound institutions for the provision of sufficiently qualified labour and ICT infrastructure. Finally, knowledge transfer through utilization of human capital and ICT is facilitated by supporting the complementary relationship between them.

Keywords: Absorption capacity, knowledge transfer, MENA Region, Egypt

JEL classification: O10, O11, O30

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Overview of Knowledge Transfer in MENA Countries – The case of Egypt

(January 30, 2014)

Executive Summary

This paper provides an overview of knowledge transfer and explains the factors that enable or impede absorption capacity and knowledge transfer in the MENA countries, with particular reference to the case of Egypt. Section 2 reviews the international literature on absorption capacity and international knowledge transfer channels including FDI, international trade, ICT, education, human capital mobility and university-industry linkage. We explain that the international literature on technology and knowledge transfer identifies different channels of international knowledge transfer and comes to mixed results regarding the effectiveness of different channels of international knowledge transfer. We explain that apart from the increasing debate in the literature regarding the effectiveness of different channels of knowledge transfer, most studies in the international literature in knowledge transfer are consistent with the view that the attainment of absorption capacity is necessary for effective knowledge transfer. Sections 3-4 examine the factors enable/impede absorption capacity and knowledge transfer channels (FDI, international trade, ICT, education, human capital mobility and university-industry linkage) in the MENA region and Egypt respectively. We find that the factors hindering absorption capacity and knowledge transfer in the MENA countries and Egypt are related to institutions, infrastructure, macroeconomic environment, higher education and training, goods market efficiency and labour market efficiency, financial market development, technological readiness and capacity for innovation. Section 4 explains that in Egypt, knowledge transfer through utilization of FDI is impeded by both economic factors due to macroeconomic instability and unfavourable environment (due to high fiscal deficit and high inflation rate) and institutional factors (due to corruption, low accountability, and poor IPRs protection), which are all below the international standards. FDI is also impeded by poor quality of infrastructure, poor R&D spending and cooperation, poor technological readiness, poor ICT infrastructure, poor capacity for innovation, poor goods market and labour market efficiency, skill gap and mismatch, poor quality of education and training, high tariff rate and prevalence of trade barriers, low financial development as measured by inadequate availability of financial services and venture capital and poor business environment. We find that in Egypt, knowledge transfer through utilization of trade is inhibited by the prevalence of trade barriers, high tariff rate and poor performance of trade policy which is below the international standards. We find that knowledge transfer through utilization of human capital and education in Egypt is immensely impeded by the poor quality of education, the high incidence of skill gap, mismatch and brain drain. We find that in Egypt, knowledge transfer through utilization of ICT is immensely impeded by the insufficient resources, poor ICT infrastructure, insufficient readiness and usage by individual and business, which are all low by international and MENA region standards, the major obstacles for ICT usage by individual are the low income level and high illiteracy rate and for the business sector are the poor adoption and lack of resources (human and financial). We find that in Egypt, knowledge transfer through utilization of university-industry linkage is immensely impeded by low public-private R&D spending and poor capacity for innovation.

For the case of Egypt, we find that the enabling environment for absorption capacity and knowledge transfer require improvement in quality of institutions, infrastructure, ICT, sufficiently qualified labour,

macroeconomic environment, higher education and training, goods market and labour market efficiency, financial market development, technological readiness, innovation and opening up to international trade. The most enabling factors for FDI and doing business are: ensuring policy stability, sufficiently qualified labour, improving access to financing, avoiding government bureaucracy, avoiding restrictive labour regulations and avoiding corruption respectively. Knowledge transfer through utilization of international trade can be facilitated by improvement of trade policy, removal of trade barriers and tariff. Knowledge transfer through utilization of ICT can be facilitated by improving resources (human and financial), infrastructure, readiness and usage. Knowledge transfer through utilization of human capital and education can be facilitated by improving the quality of education, reducing the incidence of skill gap, mismatch and brain drain. Knowledge transfer through utilization of university-industry linkage can be facilitated by improving public-private R&D spending and capacity for innovation. Specially, for the case of Egypt, the study identifies two main challenges facing promotion of absorption capacity and knowledge transfer. Mainly, from policy perspective the need for firm commitment to institutional reform and better availability, sustainability and efficiency of infrastructure and sound plans and systematic institutions that are needed for promoting the absorption capacity and knowledge transfer in Egypt. From economic and social development perspectives, the challenge for promotion of absorption capacity and knowledge is that the recent economic crisis, the high incidence of poverty and youth unemployment in Egypt implies competition for the limited financial resources allocated for youth unemployment, poverty, economic growth, promoting absorption capacity and reform of knowledge institutions. The major implication here is that more spending on promoting the absorption capacity and knowledge institutions means less spending on social development, such as youth unemployment and poverty reduction. The challenge, therefore, is how to strike the right balance when allocating government funds to different priorities in Egypt. The study thus provides implications for investment for the case of Egypt, mainly the potential role of international institutions in promoting the absorption capacity, for example by learning from specific past EIB projects that address the identified absorption capacity bottlenecks. Our results in Sections 3-4 are consistent with the stylized facts in the MENA literature regarding the impediment factors hampering the transfer of knowledge in the MENA region. Our results in Sections 3-4 are also consistent with the stylized facts in the international literature regarding the interaction and linkage between the different knowledge transfer channels as discussed in Section 2. One interesting element in our study is that we present a systematic framework for the factors enable/impede knowledge transfer in Egypt/the MENA region. The major policy implication from our findings is that knowledge transfer is facilitated by supporting the linkages between the different knowledge transfer channels within this systematic framework. Knowledge transfer through utilization of FDI is facilitated by the sound institutions for the provision of sufficiently qualified labour, ICT infrastructure, opening up to international trade, good university-industry cooperation, R&D and innovation capacity. Knowledge transfer through utilization of international trade is facilitated by the sound institutions for the provision of sufficiently qualified labour and ICT infrastructure. Finally, knowledge transfer through utilization of human capital and ICT is facilitated by supporting the complementary relationship between them.

Keywords: Absorption capacity, knowledge transfer, MENA Region, Egypt

Contents

Overview of Knowledge Transfer in MENA Countries- the case of Egypt

1. Introduction

This assignment focuses on preparation of study that aims to give overview of knowledge transfer in the Middle East and North Africa (MENA) countries.[2] In addition, the assignment consists of a study of knowledge transfer in practice, with reference to the case of Egypt. These second and third deliverable of the assignment discuss knowledge transfer channels and key domestic determinants of absorption capacity as discussed in the international, MENA and Egypt literature.

As for the methodology, this study uses the secondary data and the descriptive and comparative approaches and uses the relevant standardised indicators on knowledge transfer channels and main factors affecting the absorption capacity that often used in the international knowledge literature.

As for the structure, this paper is organised in two parts and five sections **Part One** includes Sections 2-3 and **Part Two** includes Section 4. Section 1 presents an introduction and briefly shows the aims, methodology and structure of the study. **Part One** includes Sections 2-3, it explains three issues related to knowledge transfer channels and key domestic determinants of the absorption capacity as discussed in the international literature. Section 2 aims firstly to identify the relative importance of the most relevant enabling factors for knowledge transfer, mainly we focus on the important enabling factors for the absorption capacity and hence knowledge transfer. As discussed in the available literature, these include, for instance, the level of human capital, domestic R&D, openness of academic research, university-industry links, labour and product market flexibility, the development of the financial, the facility for doing business and local competition. Secondly, this section also examines the most important channels for international knowledge transfer, including for examples, FDI, educational and research co-operation network with the international community, international trade in goods and services, ICT, and migration (e.g. diasporas). This section also explains the importance of domestic enabling factors, differences across these channels and differences across countries and regions in the relative importance of different enablers and channels. Thirdly, Section 3 examines the constraining factors in the MENA region. **Part Two** includes Section 4 and discusses the case study of Egypt, assessing the factors affecting absorption capacity and knowledge transfer in Egypt, compared to other MENA countries. Finally, Section 5 provides the conclusions and policy recommendations.

2. Review of international literature on Absorptive capacity and International knowledge transfer:

Before proceeding to **Part Two** and Section 4 and discussing the factors affecting the absorption capacity and knowledge transfer in Egypt, it is useful to begin with the review of international

[2] According to the World Bank classification and definition of world regions, the Middle East and North Africa (MENA) region includes Algeria, Djibouti, Arab Republic of Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Syrian Arab Republic, Tunisia, West Bank and Gaza and Republic of Yemen.

literature. Therefore, **Part One** and Sections 1-3 review the international literature on the relative importance of the factors affecting the absorption capacity and knowledge transfer channels.

2. 1. Review of international literature on the absorptive capacity:

This section reviews the international literature focusing on the concept “absorptive capacities".

In the international literature on knowledge economy the concept “absorptive capacities” is defined as the ability of knowledge recipient to employ new knowledge successfully (cf. Gallouj, 2000). The existing studies in the literature stressed the importance of “the absorptive capacity of the economy” and building of human capital and skills domestic workers for absorption and implementation of foreign technologies (Keller, 1996: 200). Therefore, from the existing literature, we may realise the key importance of a country’s absorption capacity for international skills- and knowledge transfer for economic policy that aims at productivity growth by increase of knowledge content and innovation. The determinants of the absorption capacity may vary across countries, but generally include the level of education and skills, labour market characteristics (such as mobility of labour), the quantity and quality of infrastructure, institutional factors such as business ownership, and openness to trade.

The concept absorptive capacity is widely used and extensively defined in the literature. The origin of the concept of the absorptive capacity refers to the broad concept of social capability including the adequacy of political, financial, educational, and economic systems (Ohkawa and Rosovsky, 1973). Absorptive capacity is defined to include all elements that determine the ability of countries to efficiently absorb and internalise foreign knowledge from lead countries (Abramovitz, 1995). National absorptive capacity is defined as “the ability to learn and implement the technologies and associated practices of already developed countries”, "national absorptive capacity is influenced by external technological environment, and firms absorptive capacity may be affected by the stock of knowledge of firms of other countries" (Dahlman and Nelson, 1995). The absorptive capacity is defined as "the ability of the laggard 'economic units' (countries or firms) to absorb, internalize and utilize the knowledge potentially made available to them, or the appropriate supply of human capital and technological capability to be able to generate new technologies and consequently use productive resources efficiently, national absorptive is affected by the international technological environment, firms’ investment in their own capacity to innovate, firms’ innovative efforts, the institutions and economic actors" (Narula, 2004). Numerous studies in the literature examine the absorptive capacity and its relationship with the technological learning and technological change at the firm level (Cohen and Levinthal 1989, 1990, Becker and Peters, 2000), few studies in the literature investigate the absorptive capacity at the macro (country, national) level and its relationship with national R&D activities. For instance, at the firm level the absorptive capacity is defined as “the faction of knowledge in the public domain that the firm is able to assimilate and exploit” (Cohen and Levinthal), absorptive capacity therefore determines a firm’s ability to incrementally increase its technological knowledge stock through the adaptation and application of outside knowledge sources, the firm can increase

absorptive capacity only if increases its R&D efforts. At the macro level, national absorptive capacity is defined as "the ability of a country to absorb foreign knowledge, absorptive capacity and the accumulation of knowledge stock are [perceived as] simultaneously determined" (Criscuolo and Narula, 2002). "The concept national absorptive capacity has been associated in the international technology transfer literature with the concept of national technological capabilities, and in the endogenous growth literature with the concept of human capital (Lucas 1988, and Romer 1990), human capital measures have been used as proxies for absorptive capacity in several empirical studies (cf. Verspagen, 1991 and Borenzstein et al., 1998)" (Criscuolo and Narula, 2002). The absorptive capacity represents a subset of technological capabilities (it is assumed to be a function of firm's R&D efforts and it is determined in part by the country R&D efforts), the primary determinant behind technological accumulation and absorptive capacity is human capital (Criscuolo and Narula, 2002). While human capital represents a core aspect of absorptive capacity, it represents a subset of absorptive capabilities, its presence is not a sufficient condition for knowledge accumulation, this requires the presence of economic actors, [formal and informal] institutions, and government policies, which are essential to promote interlinkages between the different elements of absorptive capacity and to create the opportunities for economic actors to absorb and internalize spillovers. Absorptive capacity is also affected by the systems of innovation and the knowledge infrastructure (consisting of public research institutes, universities, organisations for standards, intellectual property protection, etc. that enables and promotes science and technology development), institutions that determine the interaction between participants of an innovation system (Freeman 1992, Johnson 1992, Criscuolo and Narula, 2002; Narula, 2002; 2003; 2004).[3] The literature assumes that the absorptive capacity includes four components: firm-sector absorptive capacity, basic infrastructure, advanced infrastructure and formal and informal institutions (see Box 1) (Narula, 2004).[4] Economic actors is defined in two groups; the first group is firms – private and public – engaged in innovatory activity and the second consists of non-firms that determine the knowledge infrastructure which supplements and supports firm-specific innovation. The non-firm actors include the social and cultural context; the institutional and organizational framework; infrastructures, etc. Infrastructure includes both basic infrastructure (including the provision of primary and secondary education, electricity, telephones, postal services, hospitals, public transport, road, railways, etc.) and high-technology infrastructure (Rasiah 2002) (including universities and polytechnics capable of generating skilled technicians, engineers and scientists, and undertaking some level of basic and applied R&D). Formal institutions include the appropriate intellectual property rights regime, competition policy, the creation of technical standards, taxation, the establishment of incentives and subsidies for innovation, the funding of education, etc., informal institutions are much more difficult to quantify, but are associated with creating and promoting links between the various

[3] See Rajneesh Narula (2004) "Understanding absorptive capacities in an "innovation Systems" context: consequences for economic and employment growth". MERIT-Infonomics Research Memorandum series: 2004-003.
[4] See Sanjaya Lall and Rajneesh Narula (2004) "FDI and its role in economic development: Do we need a new agenda?" - MERIT-Infonomics Research Memorandum series: 2004-019.

actors (Narula, 2004).[5] The efficient absorption of knowledge requires the presence of institutions and economic actors within industry, efficient use of knowledge acquired, creation of new knowledge through investing in R&D, learning 'learning to learn' (Lundvall, 1992). It is not only the creation of new knowledge but also the diffusion of extant knowledge which determines the effective national technological knowledge stock and therefore the accumulation of national absorptive capacity (Criscuolo and Narula, 2002).[6]

Box 1 - The components of absorptive capacity

Basic infrastructure

Roads, railways, etc.
Telephones
Electricity
Basic skilled human capital (primary and secondary education)
Primary and secondary schools
Hospitals

Advanced infrastructure

Universities
Advanced skilled human capital (tertiary education)
Research institutes
Banks, insurance firms

Firms

Domestic firms with appropriate human and physical capital to internalize technology flows.
MNE affiliates (acting both as users and creators of technology flows)

Formal and informal institutions

Intellectual Property Rights [IPRs] regime
Technical standards, weights and measures
Incentives and subsidies to promote adoption and creation of new technologies
Taxation
Competition policy
Investment promotion and targeting schemes.
Promotion of collaboration between economic actors (domestic)
Promotion of collaboration between economic actors (foreign)
Promoting entrepreneurship

Source: Narula (2004), p. 18

2. 2. Review of the international literature on International knowledge transfer:

This section reviews the international literature on technology and knowledge transfer channels.

In the international literature on knowledge economy, knowledge transfer is defined as the process by which knowledge travels from a knowledge holder (a person, organization or country possessing the knowledge) to a knowledge recipient through one or many transfer channels including human capital mobility, ICT, training, FDI, patent, suppliers, licensing, link with academy, producer-consumer two way knowledge transfer, (cf. Cowan, Soete and Tchervonnaya, 2001). many studies in the international literature provide general surveys of the channels and impact of international technology transfer (Keller 2004; Saggi, 2002), technology transfer through FDI (Görg and Strobl, 2001; Görg and Greenaway, 2004), learning by exporting

[5] See Rajneesh Narula (2004) "Understanding absorptive capacities in an "innovation Systems" context: consequences for economic and employment growth," MERIT-Infonomics Research Memorandum series No. 2004-003.

[6] See Paola Criscuolo and Rajneesh Narula (2002) "A novel approach to national technological accumulation and absorptive capacity: Aggregating Cohen and Levinthal," MERIT-Infonomics Research Memorandum series No. 2002-016. pp. 1-8, 18-20.

(Greenaway and Kneller, 2007; Wagner, 2007; Damijan et al., 2007; De Loecker, 2007), learning by importing intermediate inputs at country level (Coe and Helpman, 1995; Coe, Helpman and Hoffmaister, 1997) and at firm level (Amiti and Konings, 2005; Kasahara and Rodrigue, 2008; Altomonte and Bekes, 2009; Muul and Pisu, 2007; Andersson et al. 2008), and through licensing (Mansfield and Romeo 1980; Mansfield, 1994). The international literature on the effectiveness of international technology and knowledge transfer channels in different countries come to mixed results on the effectiveness of different channels of international knowledge transfer on the host countries, but identifies both FDI and international trade as two major channels through which technological knowledge developed in one country is transferred across borders (Saggi, 2002; Keller, 2004; Kneller, Pantea and Upward, 2009). "The macro-level literature on international R&D spillovers largely tends to concentrate on trade-related spillovers (Keller, 1997; Coe and Helpman, 1995; 1997; Verspagen, 1997), the micro-level literature has tended to focus on inward FDI-related spillovers (Blömstrom 1989; Kokko 1994; Aitken and Harrison, 1999), very few studies have analysed the role of both inward and outward FDI as a channel of technology transfer (Potterlberghe and Lichtenberg, 2001; Braconier et al., 2002)." (Criscuolo and Narula, 2002)[7]

This section discusses the major knowledge transfer channels and the effectiveness of these channels in knowledge transfer that had been investigated in the international literature; these include, for example, FDI, international trade, ICT, human capital mobility, and university-industry linkage. Before examining knowledge transfer channels, it is useful to explain the differences and interaction between knowledge transfer channels and technology flows. "Technology flows refer to the average of technological payments and receipts.[8] Trade in technology comprises four main categories: transfer of techniques (through patents and licences, disclosure of know-how); transfer (sale, licensing, franchising) of designs, trademarks and patterns; services with a technical content, including technical and engineering studies as well as technical assistance; industrial R&D. Technology flows includes technology receipts from patents and licences and payments for R&D services are the main source of information on disembodied technology diffusion and indicate the internationalisation of technology flows. These flows reflect to some extent cross-border trade in R&D outcomes. Unlike R&D expenditures, such payments are for production-ready technologies. Over the years, international technology flows have increased, showing that knowledge generated in one country is increasingly used in another. Technology flows can be mainly due to the strong presence of foreign affiliates, and may however be affected by intra-firm transactions and transfer pricing. Royalties are an important category of international technology flows. The rise in international technology flows show that knowledge is

[7] See Paola Criscuolo and Rajneesh Narula (2002) "A novel approach to national technological accumulation and absorptive capacity: Aggregating Cohen and Levinthal," MERIT-Infonomics Research Memorandum series No. 2002-016. pp. 1-8, 18-20.

[8] Technology receipts and payments show a country's ability to sell technology abroad and its use of foreign technologies, respectively. Royalties and licence fees are payments and receipts between residents and non-residents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes and franchises) and for the use, through licensing agreements, of produced originals or prototypes (such as manuscripts, cinematographic works and sound recordings). While it is not possible to distinguish between intra- (parents and affiliates) and inter-firms transactions, the figures point to the importance of foreign affiliates' activities. For instance, technology flows can be mainly due to the strong presence of foreign affiliates, and may however be affected by intra-firm transactions and transfer pricing.

increasingly implemented in a different country from the one in which it was developed" OECD (2011).[9] The literature shows several channels of technology transfer/flows, "either through armslength means, such as through licensing, or through trade in intermediate goods, plant and equipment or even products or services, technology flows may also be made available through hierarchies, between affiliated firms within a multinational enterprise or through the modality of FDI (see Box 2)" (Narula, 2003).[10] The factors that facilitate or impede technology flows are closely related to knowledge transfer channels. Technology flows are effective for promoting the absorption capacity and transfer of knowledge through FDI and international trade in technological products. The enhancing factors for technology flows include adequate availability of financial and human resources, high skill and well-educated labour force, good infrastructure, ICT, R&D, IPR, etc.

Box 2 - Technology flows

Technology flows may occur through various means:

1. Through trade, embodied in;
   - Plant and equipment
   - Intermediate and final goods or other imports
2. Through hierarchies (i.e., inward FDI, such as MNEs), embodied in:
   - Expatriate personnel
   - Plant and equipment
   - Intermediate and final goods
   - Training provided to employees
   - Intra-firm, inter-subsidiary movement of staff
   - Inter-MNE alliances
3. Arms-length through:
   - turn-key projects
   - consultancy projects
   - licensing
   - franchising
4. Outward FDI (through reverse technology transfer)

Source: Narula (2004), p. 10

The literature identifies eleven most typical knowledge transfer channels used in manufacturing and services sectors (see Table 1). The literature indicates that "the channels of knowledge transfer in manufacturing and services are very similar, because knowledge transfer in both manufacturing and services is taking place in the era of the new economy that characterised by wide and fast spread of new technologies (especially ICT), which lead to an increasing convergence between goods and services. The main differences lie *not* in the *nature* of the channels, but in the *degree of their appropriateness* and *intensity of use*. Similarities present in knowledge transfer processes are to some extent also based on the sectors' embeddedness in the same large economic and knowledge-generating systems as well as on some "universal" features of knowledge itself." (Cowan, Soete and Tchervonnaya, 2001).[11]

[9] See OECD (2011) OECD Science, Technology and Industry Scoreboard 2011, OECD 2011, pp. 108-109. 3. Connecting to Knowledge- 10, Technology flows.

[10] See Rajneesh Narula (2004) "Understanding absorptive capacities in an "innovation Systems" context: consequences for economic and employment growth". MERIT-Infonomics Research Memorandum series: 2004-003.

[11] See Robin Cowan, Luc Soete and Oxana Tchervonnaya (2001), "Knowledge Transfer and the Services Sector in the Context of the New Economy," MERIT Research Memoranda- 2001-021. pp. 18-19.

Table 1 - The mechanisms of use of knowledge transfer channels in two sectors

Channel	Manufacturing	Services
Suppliers	Suppliers are a source of knowledge embodied in machines and/or related to machines usage and maintenance.	Suppliers of ICT-related capital goods are especially important in services, as much innovation in services is mediated by ICT.
Foreign direct investment	Access to new/complementary local knowledge and skills is gained by establishing presence abroad.	In services this channel is even more important than in manufacturing due to specificity of the mode of service delivery.
Licensing	Both the technology supplier and the technology recipient gain access to each other's knowledge (more technological in nature in the case of the latter and more 'local market - related' in the case of the former).	Franchising as a form of licensing is a transfer channel in non-technical services. Licensing as such is more relevant for software industry than for other services.
Links with academy	*Technical* expertise from academy is most relevant for manufacturing.	Health, banking and logistical services often innovate with the help of academic knowledge; other services are less likely to use academic research on a wide scale.
Training	Training is important, but not to the same extent than in services. Manufacturing companies do not accentuate training in interpersonal skills. Technical skills are a priority.	This channel is more important for services due to employees' direct involvement with customers in most services. Training in interpersonal skills is highly important in services.
Intracompany strategic knowledge management	Intranet and technologies alike enable efficient communication amongst employees, exchange of message and data files, participation in computer conferencing and so on.	Service firms practice intra-firm knowledge and information exchange by electronic means to the same extent as manufacturing firms.
Producer consumer two-way knowledge transfer	Producers often train customers to use complex equipment. Consumers' knowledge can be involved at the design stage for an individualized order.	This channel has a greater importance in services as compared to manufacturing, since consumers are often both "coproducers" and "co-innovators".
Knowledge Intensive business services	Manufacturing firms use KIBS and T-KIBS in general rather extensively.	KIBS in a broad sense can be seen as useful for all types of services, whereas T-KIBS are mostly needed in technical services such as computer, engineering and others.
Human capital mobility	This is a transfer channel for diffusion of tacit knowledge which is valuable in itself and also for spread of innovative codified knowledge.	This channel is of great importance for services as well: tacit knowledge in terms of interpersonal skills and know-how generally are crucial for many services.
Patents	Due to "disclosure" requirement patents become a means of knowledge transfer from inventor to the public (other firms and so on).	This channel is less important for service industries. Software is so far the only service industry where patents are a channel of knowledge transfer
Internet	Manufacturing firms use Internet to receive information and knowledge about suppliers, competitors, potential customers and regulations.	Service firms use Internet for the same purposes and to the same extent. An additional function of *online* service delivery is present in services (this can coincide with knowledge transfer as in online consultancy, for instance).

Source: Cowan, Soete and Tchervonnaya (2001) p. 19.

The literature defines the average importance of these channels for both sectors in five groups. "First, channels of average importance for manufacturing and services are: suppliers, licensing/franchising, intra-company strategic knowledge management, knowledge intensive business services, human capital mobility and Internet. Second, channels of average importance for manufacturing and of more importance for services are: foreign direct investment and training. Third, channel of average importance for services and of more importance for manufacturing is the links with academy. Fourth, channel of less importance for manufacturing and of more importance for services is the producer-consumer two-way knowledge transfer. Fifth, channel of less importance for services and of more importance for manufacturing is patents." (Cowan, Soete and Tchervonnaya, 2001)[12] We examine below the major channels of knowledge transfer.

[12] See Robin Cowan, Luc Soete and Oxana Tchervonnaya (2001), "Knowledge Transfer and the Services Sector in the Context of the New Economy," MERIT Research Memoranda- 2001-021. pp. 27-28.

2. 2. 1. Foreign Direct Investment and International knowledge transfer

Several studies in the literature examine the determinant (enabling factors) and the effect of FDI as a channel of knowledge and technology transfer in the host countries; the UNCTAD World Investment Reports (1998; 1999) are very useful sources to qualify them. We shall here take up part of their description.

For instance, UNCTAD (1999) finds that Transnational Corporations (TNCs) can be efficient vehicles for the transfer of technologies and skills suited to existing factor endowments in host economies. The positive FDI effects on host countries require appropriate skills, [institutions] and policies and depend on the dynamics of the transfer of technology and skills by TNCs, market orientation and size, availability of labour skills, technical capabilities, TNCs corporate strategies and resources, supplier networks, adequate infrastructure, conducive trade regime, government policies on the operations of foreign affiliates, and the state of development and responsiveness of local factor markets, firms and institutions.... The trade and competition policy regime in a host economy may encourage local and foreign enterprises to invest in developing local capabilities. A strongly export-oriented setting with appropriate incentives provides the best setting for rapid technological upgrading. The second factor concerns policies regarding the operations of foreign affiliates, including local-content requirements, incentives for local training or R&D, and pressures to diffuse technologies. .... The third factor involves TNC strategies. Host country governments can influence aspects of TNC location decisions by measures such as targeting investors, inducing upgrading by specific tools and incentives and improving local factors and institutions. The fourth factor, the state and responsiveness of local factor markets, firms and institutions, is probably the most important one. ....Without improvements in factor markets, TNCs can improve the skills and capabilities of their employees only to a limited extent.[13]

UNCTAD (1998) discusses three principal determinants of FDI location: the policy framework of host countries, the business facilitation measures to facilitate investment, and the economic factors (see Table 2). The importance of FDI determinants depends on the motive and type of investment, the industry in question, and the size and strategy of the investor. … On the policy framework the core enabling framework for FDI consists of rules and regulations governing entry and operations of foreign investors, standards of treatment of foreign affiliates, the functioning of markets, trade policy, privatization policy and the degree of openness. Thus, macroeconomic policies (monetary, fiscal and exchange-rate policies), macro-organizational policies, membership in regional integration frameworks, market size and market growth become increasingly relevant for supporting a country's investment climate…. Business facilitation measures include investment promotion, incentives, after-investment services, improvements in amenities and measures that reduce the "hassle costs" of doing business, notably, after-investment services is important

[13] See UNCTAD, (1999), World Investment Report 1999: Foreign Direct Investment and the Challenge of Development: *Overview*, United Nations, New York and Geneva, 1999, pp. 41-45. Once host countries build strong local capabilities, TNCs can contribute positively by setting up R&D facilities. However, at the intermediate stage, the entry of large TNCs with ready-made technologies can inhibit local technology development, especially when local competitors are too far behind to gain from their presence. Where a host economy adopts a proactive strategy to develop local skills and technology institutions, it may be able to induce TNCs to invest in local R&D even if there is little research capability in local firms.

because of the importance of reinvested earnings in overall investment flows, financial or fiscal incentives are also used to attract investors. … The economic factors are defined into three clusters, corresponding to the principal motives for investing abroad: resource (or-asset)-seeking, market-seeking and efficiency-seeking. Historically, the availability of natural resources has been the most important FDI determinant for countries lacking the capital, skills, know-how and infrastructure required for their extraction and sale to the rest of the world. National market size, in absolute terms or relative to the size and income of the population, has been another important traditional determinant, leading to market-seeking investment, high market growth rates stimulate investment by foreign and domestic investors. Largely immobile low-cost labour was another traditional economic determinant of FDI location, particularly important for efficiency-seeking investment……..Other factors such as globalization, technology and innovation, openness to trade, technology flows, deregulation and privatization are changing the relative importance of different economic determinants of FDI location. Other locational determinants are productivity, reliability of the labour supply, good infrastructure facilities, reliable telecommunication infrastructure, adequate physical infrastructure for the export of final products, access to international markets, removal of trade (and FDI) barriers, technological advances, availability of low-cost unskilled labour and availability of human capital and high level of skill..… To attract FDI, it is no longer sufficient for host countries to possess a single locational determinant, but the presence of state-of-the-art FDI frameworks that provide them with the freedom to operate internationally, that are complemented by the relevant bilateral and international agreements, and that are further enhanced by a range of business facilitation measures. The economic determinants of enhancing FDI include not only possessing of natural resources but also possessing of "created assets", the rise in the importance of created assets is the single most important shift among the economic determinants of FDI location in a liberalizing and globalizing world economy. The enabling policies for strengthening of created assets include not only cost reduction and bigger market shares, but also access to technology and innovative capacity, strengthening innovation systems, encouraging the diffusion of technology, development of clusters, policies that stimulate partnering and networking among domestic and foreign firms, … the distinctive combination of locational advantages (human resources, infrastructure, market access and the created assets of technology and innovative capacity) that a country or region can offer potential investors.[14]

UNCTAD (1998) indicates that the low share of Central and Eastern Europe in world inward FDI stock (1.8 per cent in 1997) to a large extent is explained by the fact that the majority of the countries opened up to inward FDI fairly recently; their accumulated FDI stocks are therefore small. It indicates that the small stock also reflects the influence of various obstacles such as problems in the legal and regulatory frameworks; a long transition-related recession and a lack of experience in FDI facilitation measures (see Figure 1).

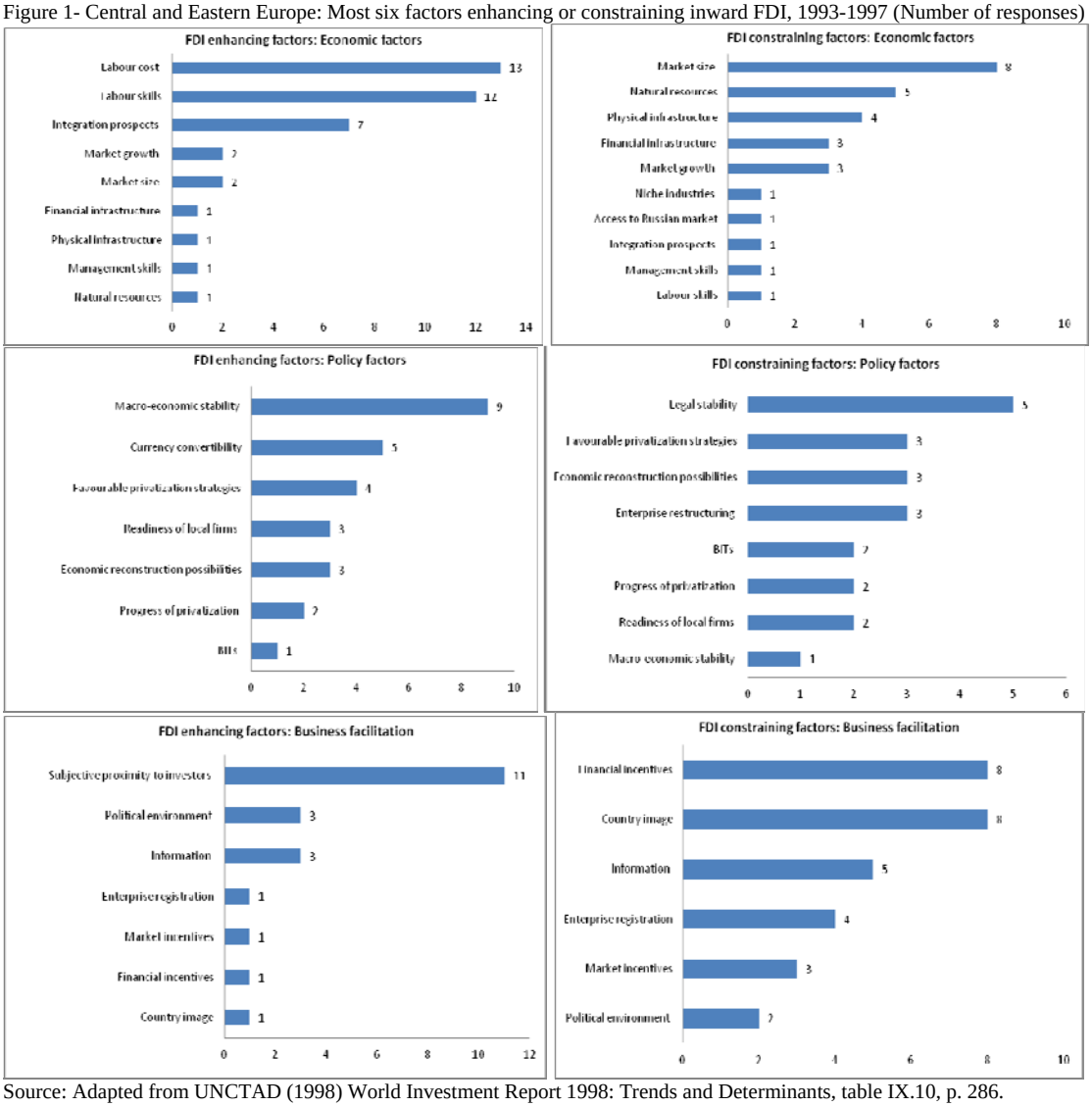
[14] For this whole part, see UNCTAD (1998) "World Investment Report 1998: Trends and Determinants" Overview: pp. 26-37.

Table 2 - Host country determinants of FDI

Host country determinants	Type of FDI classified by motives of TNCs	Principal economic determinants in host countries
I. Policy framework for FDI • economic, political and social stability • rules regarding entry and operations • standards of treatment of foreign affiliates • policies on functioning and structure of markets (especially competition and M&A policies) • international agreements on FDI • privatization policy • trade policy (tariffs and NTBs) and coherence of FDI and trade policies • tax policy II. Economic determinants III. Business facilitation • investment promotion (including image building and investment-generating activities and investment-facilitation services) • investment incentives • hassle costs (related to corruption, administrative efficiency, etc.) • social amenities (bilingual schools, quality of life, etc.) • after-investment services	**A. Market-seeking**	• market size and per capita income • market growth • access to regional and global markets • country-specific consumer preferences • structure of markets
	B. Resource/ asset-seeking	• raw materials • low-cost unskilled labour • skilled labour • technological, innovatory and other created assets (e.g. brand names), including as embodied in individuals, firms and clusters • physical infrastructure (ports, roads, power, telecommunication)
	C. Efficiency-seeking	• cost of resources and assets listed under B, adjusted for productivity for labour resources • other input costs, e.g. transport and communication costs to/from and within host economy and costs of other intermediate products • membership of a regional integration agreement conducive to the establishment of regional corporate networks

Source: UNCTAD (1998) "World Investment Report 1998: Trends and Determinants", Table IV.1, p. 91.

Figure 1- Central and Eastern Europe: Most six factors enhancing or constraining inward FDI, 1993-1997 (Number of responses)



Source: Adapted from UNCTAD (1998) World Investment Report 1998: Trends and Determinants, table IX.10, p. 286.

Apart from the increasing debate on the determinants of FDI, studies regarding the effectiveness of FDI as a mechanism of technology diffusion and a channel of knowledge transfer show increasing debate and come to different and mixed results. On the one hand, the views in suspecting the effectiveness of FDI as a mechanism of technology diffusion and a channel of knowledge transfer are based on the argument that "a cornerstone of the theory of FDI says that firms choose to operate through a fully-owned subsidiary instead of through joint ventures or technology licensing because FDI helps to keep the private return to technology investments *internal* to the firm—that is, no leaking out of knowledge. In general, the evidence for positive effects from inward FDI is stronger for more developed than for less developed countries. This might have to do with the fact that outsourcing of relatively low-skill activities is more likely for North-South FDI than for North-North FDI (e.g., Hanson, Mataloni, and Slaughter, 2001). The former could have a lower learning potential than the latter, not necessarily because the activities are different as such, but because they are integrated with the host country economy to different degrees (in terms of backward and forward linkages)"(Keller, 2001). "At the aggregate level, FDI has positive effect on economic growth in the host country, but FDI positive impact on the productivity of local firms effect have been questioned by earlier studies" (Saggi, 2002).[15] This argument is confirmed in several studies that find negative effects of foreign presence (FDI) on the productivity of local firms in the host country in Morocco (Haddad and Harrison 1993), in Venezuela (Aitken and Harrison 1999) and in the Czech Republic (Djankov and Hoekman 1998).

On the other hand, the views in support of the effectiveness of FDI as a mechanism of technology diffusion and a channel of knowledge transfer are based on the argument that "FDI implies a direct transfer of technology from parent MNEs to their foreign affiliates and has long been considered one of the major channels of international technology transfer…. When an MNE undertakes foreign production it exports services of these firm specific assets to its foreign affiliates (Markusen, 2002). In turn, this means that foreign affiliates of MNEs should benefit from this knowledge transfer from their parent MNEs." (Kneller, Pantea and Upward, 2009).[16] This argument in the literature is supported by the incidence of positive spillovers, for instance, the positive relationship between foreign presence (FDI) and local firms' technical efficiency in Australian manufacturing (Caves 1974), spillover benefits to Canadian manufacturing industries (Globerman 1979), technical efficiency and positive influence on domestic labour productivity in Mexico (Blomstrom and Pearson 1983), high level of labour productivity and intra-industry spillovers from foreign investment existed in the Indonesian manufacturing (Blomstrom and Sjoholm 1999) and spillovers on Indonesian manufacturing industry (Sjoholm 1997, Takii 2001). The literature supports the arguments that FDI serve as a channel of international technology and knowledge transfer across international borders are based on the idea that "foreign affiliates can be

[15] See Kamal Saggi (2002) "Trade, Foreign Direct Investment, and International Technology Transfer: A Survey," Oxford Journals, Economics & Social Sciences , World Bank Research Observer, Volume17, Issue2, Pp. 191-235, World Bank Res Obs (2002) 17 (2): 191-235, Oxford University Press 2002.

[16] See Richard Kneller, Smaranda Pantea and Richard Upward (2009) "Which International Technology Transfer Channels Are Effective in Raising Firm Productivity?", University of Nottingham, Research Paper GEP December, 2009. pp. 2, 4-6, 36-37.

a potential source of knowledge externalities for host countries; FDI is important channel of transmitting technologies and know-how across countries" (Javorcik, 2010).[17] "FDI acquisition is an important vehicle or channel of direct international technology transfer from foreign multinationals to domestic exporters; firms with higher pre-acquisition productivity level experience the larger efficiency gains; there is heterogeneity in learning abilities, high productivity companies have higher absorptive capacity" (Girma, Kneller and Pisu, 2007).[18] "FDI is a significant channel for knowledge spillovers, both from investing firms to indigenous firms and from indigenous firms to investing firms, as observed from patent citations between Japanese investing firms and American indigenous firms (Branstetter, 2000).[19]" Some of the most significant aspects of *potentially positive* spillovers are those associated with and through human capital development. MNEs can influence human capital in the host country, through direct increases in the *quality* of the domestic workforce, by providing formal and informal training (and education to their workers or potential workers), and through the process of learning-by-doing to transfer their superior technological knowledge to their domestic employees. Domestic firms will benefit from having access to MNEs affiliates provision of training, technical assistance and more productive trained employees. In Argentina the role of FDI increased most significantly in those sectors most affected by liberalisation, deregulation and new investment incentives to attract foreign capital FDI participation in the telephony services sector increased from less than 1% before 1990 to 100% in 1998, similarly for utilities, which include electricity, gas and water services, and the informatics and communications equipment sectors." (Narula and Marin, 2003)[20] "Liberalisation has not always increased FDI inflows into host developing countries, because the removal of restrictions on FDI does not create the complementary factors that MNEs need; it only allows them to exploit existing capabilities more freely. Thus, FDI response tends to be most vigorous where local capabilities are strong when liberalization takes place, and feeblest where they are weak (of course, excluding resource extraction). FDI inflows rise where local capabilities are strengthened and new capabilities are created, they stagnate or fall where they are not. The effect of spillovers from MNE activities depends on local absorptive capacity, complementary assets in the host country, scope and competence of the subsidiary, local competence: advanced specialised skills, strong industrial and service firms and clusters, and strong support institutions. Countries that receive FDI with the highest potential for capability development are, ironically, those with strong domestic absorptive capacities. FDI transfers technology to local firms in four ways: backward linkages, labour turnover, horizontal linkages and international technology spillovers, backward linkages determinants include those internal to MNEs and those associated

[17] See Beata S. Javorcik *(2010)* "*Entry for Encyclopedia of Financial Globalization:* Foreign Direct Investment and International Technology Transfer," September, 2010: http://www.chch.ox.ac.uk/sites/default/files/Javorcik.pdf.

[18] See Sourafel Girma, Richard Kneller and Mauro Pisu (2007) "Do exporters have anything to learn from foreign multinationals?" European Economic Review, Volume 51, Issue 4, May 2007, Pages 993-1010, http://www.sciencedirect.com/science/article/pii/S0014292106001024

[19] See Gwanghoon Lee (2004) "The Effectiveness of International Knowledge Spillover Channels," Revised Manuscript paper, Chung-Ang University, Seoul, Korea, pp. 2-7.: http://cau.ac.kr/~glee/papers/EER_glee04.pdf

[20] See Rajneesh Narula and Anabel Marin (2003), "FDI spillovers, absorptive capacities and human capital development: evidence from Argentina**,"** Second draft 19 July 2003**.**

with host economies" (Lall and Narula, 2004).[21] "spillovers from FDI are regarded as one of the most practical and efficient means by which industrial development and upgrading can be promoted (Narula and Dunning 2000) "(Narula, 2003).[22]

2. 2. 2. International Trade and International knowledge transfer

Several studies in the literature identify international trade as a channel of international technology and knowledge transfer. Studies regarding the effectiveness of international trade as a mechanism of technology diffusion and a channel of knowledge transfer come to different and mixed results. On the one hand, the views in suspecting the effectiveness of international trade as a mechanism of technology diffusion and a channel of knowledge transfer are based on "the findings against significant international knowledge spillover effects through import flows (Kao et al., 1999; Kao and Chiang, 2000)." (Lee, 2004)[23] "While, imports are significant channel of technology diffusion, the evidence for benefits associated with exporting is weaker" (Keller, 2004).[24]

On the other hand, the views in support of the effectiveness of international trade as a mechanism of technology diffusion and a channel of knowledge transfer are inspired by the pioneering work of Coe and Helpman (1995) and Keller (1998), and are based on the argument on "the theoretical models by Ethier (1982), Markusen (1989) and Grossman and Helpman (1991), which shows that firms that import intermediate inputs can enjoy productivity gains due to access to a greater number of varieties or access to higher quality inputs, international technology transfer can take place also through learning by exporting." (Kneller, Pantea and Upward, 2009).[25] This argument is also based on the robust link between imports and technology diffusion and the belief that trade facilitates international technology diffusion (Keller, 2001).[26] This argument is also based on the idea that knowledge originating in a particular country or region increasingly transcends national boundaries and contributes to the productivity growth of other geographic areas, or at least, reduces duplication of the research effort.[27] This argument is also based on the assumption that international trade can be a source of spillovers through demonstration effects when domestic firms learn the innovative content of imported goods, the results that foreign R&D influences domestic productivity and that the more countries are open to international trade the more they benefit.[28] Moreover, this argument in the literature is also based on the presumption that "technology is embodied in a particular channel of knowledge transmission, the main channels are

[21] See Sanjaya Lall and Rajneesh Narula (2004) "FDI and its role in economic development: Do we need a new agenda?" MERIT-Infonomics Research Memorandum series: 2004-019.
[22] See Rajneesh Narula (2004) "Understanding absorptive capacities in an "innovation Systems" context: consequences for economic and employment growth". MERIT-Infonomics Research Memorandum series: 2004-003.
[23] See Gwanghoon Lee (2004) "The Effectiveness of International Knowledge Spillover Channels," Revised Manuscript paper, Chung-Ang University, Seoul, Korea, pp. 2-7.: http://cau.ac.kr/~glee/papers/EER_glee04.pdf
[24] See also Keller, Wolfgang. (2004) 'International Technology Diffusion,' *Journal of Economic Literature*, 42, pp.752-782: http://spot.colorado.edu/~kellerw/ITD.pdf, see pp, 1-2. Vol. XLII, September 2004, pp.752-782.
[25] See Richard Kneller, Smaranda Pantea and Richard Upward (2009) "Which International Technology Transfer Channels Are Effective in Raising Firm Productivity?", University of Nottingham, Research Paper GEP December, 2009. pp. 2, 4-6, 36-37.
[26] See Wolfgang Keller (2001) "International Technology Diffusion," National Bureau of Economic Research (NBER) Working Paper 8573, Massachusetts, Cambridge, October 2001, PP. 44-46: http://www.nber.org/papers/w8573, pp. 44-46.
[27] See Grossman, GM. and Helpman, E. (1991) for a review the endogenous growth theory.
[28] For instance, 60 percent of US long-term growth is attributed to embodied knowledge (Greenwood et al., 1997).

import flows, cross border investments, and disembodied direct channel"(Lee, 2004)[29]. The statement in the literature is also based on the argument that "international trade and/or international investment is considered as the carrier of international spillovers of knowledge and new technology and mechanism of technology (technological knowledge) transfer through international trade flows using patent citation as a direct measure of disembodied knowledge flows and a measure of innovative firm's learning process. And the argument that trade flows carry knowledge across borders, the more a country is involved in international trade, the more it tends to cite foreign patents, trade transfers technology across countries and sectors, but the extent of the diffusion depends mainly on cultural and historical proximities and the level of technical capacity of host countries. And the identification of three mechanisms to assess the impact of trade openness on technology diffusion: the degree of international openness can affect the rate of domestic innovation, the quantity of transferred technology or the adoption rate of more advanced countries' technologies (Redding and Proudman, 1998)." Bascavusoglu (2005).[30] This argument is confirmed in several studies, which find significant international knowledge spillover effects through the import flows channel (Coe and Helpman, 1995; Coe, Helpman, and Hoffmaister 1997; Lichtenberg and van Pottelsberghe,1998; Keller 2000; Potterie and Lichtenberg 2001), through disembodied cross-border spillovers (Guellec and van Pottelsberghe, 2001) and through the positive impact of exports on learning effects in South Korea and China (Kraay 1999; Hahn 2004). "The literature on technology spillovers has moved increasingly away from single-channel analyses to multiple-channel analyses, or at least to work that simultaneously controls for overall spillovers, the literature indicates that other mechanisms such as person-to-person communication is difficult to separate from trade and FDI, because the ease of communication is affecting the likelihood of trade relations" (Keller, 2001; 2004).[31, 32] The theoretical literature on international technology transfer has identified two major channels through which technology developed in one country is transferred across borders: FDI and international trade (Kneller, Pantea and Upward, 2009).[33] Other studies in the literature "identify four channels that can drive the international knowledge transfer, and show that knowledge transfer through technology transfer have significant and positive effect on the productivity of industrial enterprises in China; while

[29] See Gwanghoon Lee (2004) "The Effectiveness of International Knowledge Spillover Channels," Revised Manuscript paper, Chung-Ang University, Seoul, Korea, pp. 2-7.: http://cau.ac.kr/~glee/papers/EER_glee04.pdf

[30] See Elif Bascavusoglu (2005) "Does International Trade Transfer Technology to Emerging Countries? A Patent Citation Analysis" Open University Research Centre on Innovation, Knowledge and Development WORKING PAPER No 14, SEPTEMBER 2005. pp. 1-2, 6-7, 33: http://www.open.ac.uk/ikd/workingpapers/workingpaper_14.pdf

[31] See Wolfgang Keller (2001) "International Technology Diffusion," National Bureau of Economic Research (NBER) Working Paper 8573, Massachusetts, Cambridge, October 2001, pp. 44-46: http://www.nber.org/papers/w8573, pp. 44-46.

[32] See Wolfgang Keller (2004). "International Technology Diffusion", Journal of Economic Literature, vol. 42 (3), pp. 752-782. Keller (2004) explains the importance of international technology diffusion considering technology as technological knowledge and examines the importance of specific channels of diffusion, (trade, FDI, etc.).

[33] See Richard Kneller, Smaranda Pantea and Richard Upward (2009) "Which International Technology Transfer Channels Are Effective in Raising Firm Productivity?" University of Nottingham, Research Paper GEP December, 2009. pp. 2, 4-6, 36-37. Firms can also acquire technology from abroad through licensing agreements. Licensing typically involves the purchase of production and distribution rights for a product and the underlying knowledge technical information and know how necessary for its production. However, many technologies are not available through licensing. An important reason why firms exploit their technology assets through FDI rather than licensing is to overcome difficulties related to writing and enforcing licensing contracts (Dunning, 1993; Markusen, 1995). Mansfield (1994) finds that US MNEs are less likely to transfer advanced technologies through licensing to unaffiliated companies compared to foreign owned affiliates, especially in countries with weak intellectual protection rights.

knowledge transfer through FDI has significant and negative effect, the impact of product export and product import is complicate with different countries or regions" (Zhou and Cecere, 2010). The literature finds that "firms with international linkages (through FDI, foreign ownership, exporting, exports, imports and licensing) are more productive, the FDI effect is greater than the effect of export activities, both licensing and importing technology affect positively to the productivity, internal plant characteristics such as the share of skilled labour can enhance the productive role of international linkages for Turkish manufacturing plants" (Yasar and Paul, 2007).[34] The literature shows that "international knowledge spillovers through inward FDI and the disembodied direct channel are significant and robust, in contrast, both outward FDI and imports of intermediate goods are ineffective channels and are not conducive to international knowledge spillovers" (Lee, 2005).[35] "Foreign ownership, supplying MNEs, exporting and importing are associated with higher firm productivity, but there is no evidence that intra industry FDI spillovers or acquiring licensing agreements are associated with higher firm productivity in Central and Eastern Europe" (Kneller, Pantea and Upward, 2009).[36]

2. 2. 3. Information and Communication Technology and International knowledge transfer

The literature discusses the role of ICT and explains that "ICTs are indispensable to access the tremendous world of digital knowledge, today modern ICT offers the most promising option to improve access to knowledge, ICTs enable the rapid generation, assimilation and dissemination of knowledge" (Rave, 2008).[37] The argument in the literature in support of ICT as a channel of knowledge transfer is based on the recognition of the ability and role of ICTs to improve the transferability of knowledge, the role of ICTs to favour the transfer of knowledge that can be codified and the role of ICTs in the transfer of tacit knowledge and relationship between them (Roberts, 2010).[38] This argument in the literature is also based on the belief concerning "a vital role ascribed to computer and telecommunication systems in the process of knowledge transfer, different ICT systems, which are designed to handle different kinds of information and data, are appropriate to the transfer of different kinds of knowledge. ICT can be useful for supporting the exchange of both explicit and tacit knowledge; nonetheless, this exchange requires not only the "transmission" of knowledge, but also its *interpretation* and *acquisition* by the receiver. ICT

[34] See Wei Zhou and Grazia Cecere (2010) "Knowledge transfer, own technological efforts and productivity: The experience of China's Large and Medium-sized Industrial Enterprises"25 February 2010. pp. 1, 3-6, 20-21.
[35] See Gwanghoon Lee (2005) "The effectiveness of international knowledge spillover channels," Available online 29 November 2005. European Economic Review, Volume 50, Issue 8, November 2006, pp. 2075-2088. http://www.sciencedirect.com/science/article/pii/S001429210500125X. see also Gwanghoon Lee (2004) "The Effectiveness of International Knowledge Spillover Channels," Revised Manuscript paper, Chung-Ang University, Seoul, Korea.: http://cau.ac.kr/~glee/papers/EER_glee04.pdf
[36] See Richard Kneller, Smaranda Pantea and Richard Upward (2009) "Which International Technology Transfer Channels Are Effective in Raising Firm Productivity?" University of Nottingham, Research Paper GEP December, 2009. pp. 2, 4-6, 36-37.
[37] See Peter Rave (2006), "ICT as a tool for knowledge transfer", *Rural 21 – 06/2008. June, 2008, Rural 21, The International Journal for Rural Development*, Published by DLG-Verlag GmbH, Frankfurt, Germany, pp. 18-20 Deutsche Gesellschaft, für Technische Zusammenarbeit, (GTZ) GmbH, Eschborn, Germany: http://www.rural21.com/uploads/media/R21_ICT_as_a_tool_for_knowledge_transfer_0608.pdf.
[38] See Joanne Roberts (2010) "From Know-how to Show-how? Questioning the Role of Information and Communication Technologies in Knowledge Transfer" Technology Analysis & Strategic Management, Volume 12, Issue 4, 2000, August, 2010, pp. 429-443. Taylor & Francis Group, Routledge.

applications can greatly support and improve the process of knowledge exchange between organisations, by facilitating the efficient long distance communication, the exchange of large amount of information and the availability of research facilities." (Bolisani and Scarso, 1999)[39] The argument in the literature in support of ICT is also based on the contribution of ICT to making communication more efficient by removing certain barriers, "ICT is expected to have a positive contribution to knowledge-sharing processes in two respects: ICT offers opportunities to enhance the efficiency of such processes, and it leads to collectivist norm within a group, and hence can positively influence knowledge sharing," (Van den Hooff, de Ridder and Aukema, 2004).[40]

2. 2. 4. Human capital mobility and International knowledge transfer

Several studies in the literature examine the various types of human capital mobility across national borders and find that various groups of highly skilled persons are driven by different push and pull factors that play important role in the choice of highly skilled migrants to relocate overseas (Mahroum, 2002).[41] Some studies observe the surprising neglect of international migration as a channel of knowledge creation and transfer, and of learning and lack of focus on privilege the role of international migration vis-à-vis other channels (cf. Koser and Salt, 1997: 299; Williams, 2005). This observation is based on the argument that the literatures recognise the importance of 'travel', or 'mobility' to knowledge transfer and innovation, but pay little attention to the actual role of (international) migration in transferring particular types of knowledge, or the obstacles to this, and neglect how learning and knowledge creation/transfer are distributed throughout the labour force rather than perceived as elite practices in privileged regions (Williams, 2005). [42] Apart from this debate, the international migration literature recognises the importance of migration to knowledge economies, perceives that "it is an 'inseparable' segment of national technology and economic development policies," Mahroum (2001: 27), and realises the role of labour mobility and informal networks as mechanisms facilitating the spillovers and flow of knowledge (Fornahl, Zellner and Audretsch, 2005).[43] "There has been growing recognition that mobile, 'knowledgeable' or 'learning' individuals have the potential to forge translocal networks, cross-cutting as well as connecting innovative locales or territories" (Bunnell and Coe, 2001: 581-2). This growing recognition in the literature is based on the argument that "all mobile individuals are bearers of knowledge, whether or not they link innovative or non-innovative territories, or organisations" (Williams, 2005), and the belief that "international migration and human mobility

[39] See Ettore Bolisani and Enrico Scarso (1999) "Information technology management: a knowledge-based perspective" Technovation, Volume 19, Issue 4, February 1999, pp. 209-217. : http://www.sciencedirect.com/science/article/pii/S0166497298001096#sec5.

[40] See Bart van den Hooff, Jan de Ridder and Eline Aukema (2004) "Exploring the eagerness to share knowledge: the role of social capital and ICT in knowledge sharing," chapter 7 in Marleen Huysman and Volker Wulf (2004) (eds.) "social capital and information technology," Massachusetts institute of technology, 2004, pp. 163-183.

[41] See Sami Mahroum (2002) "Highly skilled globetrotters: mapping the international migration of human capital" R&D Management, R&D Management, Volume 30, Issue 1, pp. 23–32, January 2002, Wiley and Blackwell. The different push and pull factors include for instance, the immigration legislation, taxation, studying abroad, quality of work, openness in communication, business expansion overseas, labour market supply and demand signals, etc.

[42] See Allan Williams (2005) "International Migration and Knowledge," Centre on Migration, Policy and Society Working Paper No. 17, University of Oxford, 2005 WP-05-17, pp. 1-2, 7-8, 32-33: http://www.europe.canterbury.ac.nz/publications/pdf/williams_compas_wp17.pdf

[43] see Dirk Fornahl, Christian Zellner, David B. Audretsch (2005) "The role of labour mobility and informal Networks for knowledge transfer," Springer, 2005, Business and Economics.

transfers not only human capital but also knowledge and material capital" (Williams, 2009).[44, 45] This growing recognition in the literature is also based on the belief that "the value of human capital mobility as a knowledge transfer channel is based on the fact that human beings are "carriers" of tacit knowledge, which is often unique and inseparable from its holder. Tacit knowledge does not only have value in itself -- it can also help the diffusion of codified knowledge in innovative activity (European Commission, 2000). Both manufacturing and services firms can benefit from well-organized human capital mobility -- the one which can be achieved by "stimulating co-operation among firms in their knowledge activities, or by facilitating senior knowledge workers visiting, for a medium period, other firms, universities, or research institutes" (European Commission, 2000: 7). For a small country like the Netherlands this channel of knowledge transfer is very important with respect to both major dimensions of human capital mobility, one is getting access to new expertise by Dutch specialists going abroad, and the other is receiving new knowledge from foreign experts coming to the Netherlands" (Cowan, Soete and Tchervonnaya, 2001).[46] Most studies focuses on the size and direction of migratory flows assuming a clear correlation between human mobility and transfer of knowledge to identify the "winning" and "losing" regions. Some studies examine the relationship between highly skilled scientific migration or scientific mobility and transfer of knowledge within the European Union, and implications for sending and receiving countries and individual scientists (Ackers, 2005).[47]

2. 2. 5. University-industry linkage and International knowledge transfer

The literature explores the university-industry linkage as a channel of knowledge transfer between university and industry in the Netherlands (Bongers et al. 2003; Brennenraedts, Bekkers and Verspagen, 2006) and examines the Industry Science Relation (ISR) in the United States (Cohen et al., 2002). The study in the channels used in knowledge transfer between university and industry in the Netherlands finds that "part-timers[48] and respondents with a strong academic reputation form special types of 'knowledge transferors'. Whereas part-timers rely strong on personal networks, the latter group of respondents embraces traditional academic values and relies heavily on traditional academic channels of knowledge transfer (academic publications, conferences). The study finds that knowledge transfer is a multi-faceted phenomenon and identifies many important channels of knowledge transfer to industry. The study suggests that a policy aimed at a multitude of incentives and a wide range of channels is likely to be more effective than a policy that depends strongly on a single type of incentives. The study discusses the different channels of ISR (e.g. publication and conference participation) and finds that

[44] See Allan Williams (2005) "International Migration and Knowledge," Centre on Migration, Policy and Society Working Paper No. 17, University of Oxford, 2005 WP-05-17, pp. 1-2, 7-8, 32-33: http://www.europe.canterbury.ac.nz/publications/pdf/williams_compas_wp17.pdf
[45] See Allan M. Williams (2009) "International Migration, Uneven Regional Development and Polarization", London Metropolitan University, UK. INTERNATIONAL MIGRATION, UNEVEN REGIONAL: eur.sagepub.com/content/16/3/309.full.pdf.
[46] See Robin Cowan, Luc Soete and Oxana Tchervonnaya (2001), "Knowledge Transfer and the Services Sector in the Context of the New Economy," MERIT Research Memoranda- 2001-021. p. 17.
[47] See Louise Ackers (2005) "Moving People and Knowledge: Scientific Mobility in the European Union, Article first published online: 15 November 2005, International Migration, Volume 43, Issue 5, pp. 99–131, December 2005, Wiley and Blackwell.
[48] Part-timers are staff that holds both an appointment in industry and university.

although the mobility of star-scientist from university to the industry seems an important source of knowledge transfer, for a long time, mobility has not been seen as a way of knowledge transfer. Nevertheless, understanding of the important role of mobility is growing and it is recognized that the role of mobility has been underestimated (Bongers et al. 2003). Zucker et al. (1997) show for example the massive importance of the mobility of star-scientist from university to the industry. Mobility can also be important if university researchers have part-time job in industry. Difficulties can occur if researchers experience lock-in effects as a result of extreme specialization at universities. The knowledge they have cumulated is hard to transfer and very few companies actually need such (over-)specialized researchers as employees. Studies regarding the mobility in the Netherlands come to different results. According to OECD (2002) mobility in the Netherlands is quite high, however Bongers et al. (2003) considers it to be relatively low. Many contacts between industry and universities seem to be informal. For example, in the United Kingdom only 10% of the innovative companies have formal contacts with universities, while almost 50% of them consider universities to be an important source of innovation (OECD, 2002). A well-known form of knowledge transfer on an informal basis is the flow of information via social networks. Social networks that are shaped by the education system, for example alumni societies have a strong influence on ISR. First contact between universities and industry often originates from personal networks (Bongers et al. 2003). Some mutual benefits have to occur to establish a long-term relationship and cooperation in R&D. Industry and university can transfer knowledge by cooperating in education. Since education is one of the core-businesses of the academe, it can also be used to educate employees of the industry. Another way of cooperation is the influence industry exerts on the curriculum. By doing this they can help the university to stay in touch with (local) economy and provide themselves with a well-educated labour market. Some problems can arise using these channels, as a result of the different incentive structures. The industry wants the answer to their question to be exclusively for them, academic researchers want to transform their research into publications. IPRs have the intention to stimulate innovation by temporarily monopolizing new knowledge and publicizing it"(Brennenraedts, Bekkers and Verspagen, 2006)[49]

3. Factors enable/impede absorption capacity and knowledge transfer in the MENA region

Based on the above background, and along the lines of the increasing interest in the international literature, the argument in support of knowledge economy, knowledge transfer and improving the absorption capacity has gained ground in the MENA region as well. We are aware of the considerable variation across the MENA countries regarding the performance in many indicators related to absorption capacity and knowledge transfer (e.g. investment in education, ICT, etc.), which implies that probably, it is somewhat problematic to make generalization about the performance of the region as a whole as each country has had its own experience. Nevertheless,

[49] For this whole part, see Reginald Brennenraedts, Rudi Bekkers and Bart Verspagen (2006) "The different channels of university-industry knowledge transfer: Empirical evidence from Biomedical Engineering," Eindhoven Centre for Innovation Studies, the Netherlands, Working Paper 06.04, pp. 5-7.

the MENA countries tend to share common problems regarding the weak performance in several indicators related to absorption capacity and knowledge transfer (e.g. institutions, poor quality of education, skill gap, R&D, capacity for innovation, etc.). Apart from the observed differences, our analysis is based on the common problems hampering the absorption capacity and knowledge transfer in the MENA region as a whole. Therefore, this section uses the existing literature and statistics in the MENA countries to examine the factors that hampered the absorption capacity and the important channels of knowledge transfer, mainly, FDI, trade, ICT, education and human capital mobility, university-industry linkage and R&D in the MENA countries.

3. 1. Factors enable /impede FDI in the MENA countries

Several studies in the MENA region discuss the factors that hampered FDI, which is important channel of knowledge transfer. For instance, some studies reported that "the MENA countries have been remarkably unsuccessful in attracting FDI" (the United Nations report 2004; Moosa and Cardak, 2005), “the Arab world has continued to receive the least stock of FDI in the world despite its robust resource endowments and oil wealth” (Onyeiwn, 2000). The interpretation of this situation in the literature indicate that "the MENA’s poor record concerning FDI, relative to other regions, is attributable to many factors, specially, unstable political climate and the business climate relevant to attracting FDI. …. Syria and Iraq have a centralized economy dominated by public enterprises, state monopolies, and state financial institutions. Algeria and Lebanon have experienced several years of domestic military conflict. Up to a few years ago, GCC countries had highly protected economies. Foreign investors in most countries were prevented from having full control of a business entity; in some sectors such as banking, new domestic or foreign investment were not allowed. The situation is improving, but the region is lagging behind Asian and Latin American markets that have deregulated and opened their economies at a much faster pace." (Corm, 2006).[50] The literature "identifies as barriers to FDI inflows to the region some economic factors as well as institutional factors, bureaucracy, financial corruption and lack of infrastructure particularly outside urban areas, further problems are caused by the centralisation of government decision making and the multiplicity of parties with which a foreign investor must deal" (the United Nations report, 2004). The literature examines the determinants, notably, the economic factors that determine FDI inflows in the MENA countries and shows that "FDI can be explained in terms of the GDP growth rate, enrolment in tertiary education, spending on research and development, country risk and domestic investment, countries that are more successful in attracting FDI are those countries that have growing economies, that pay attention to education

[50] A large part of the FDI received by the region is, in fact, intraregional, as GCC investment has been rising in certain sectors, like tourism, luxury housing complexes, and commercial malls. Moreover, an important part of the FDI flows is due to investments in the energy sector by large international oil companies or to the partial privatization of the telecommunications sector in almost all Arab countries. FDI into the industrial sector or into high value added services seems to be marginal. Within the region, it appears that two Maghreb countries, namely Tunisia and Morocco, have been able to increase substantially their share of the regional total from about 20 percent in 1990 to 31 percent in 2003, whereas the GCC’s share declined from 51 percent to 39 percent. Saudi Arabia, with its large energy resources and petrochemical industries, was attracting 45 percent of total FDI in the region in 1990, but saw its share decline to 23 percent by 2003. Egypt has been the second most successful country in the region in attracting FDI. See Georges Corm (2006) the World Bank "Labor Migration in the Middle East and North Africa A View from the Region," pp. 21-25.

and research, that have low country risk and that have high return on capital die to the lack of domestic investment in fixed capital." (Moosa and Cardak, 2005) [51]

Other study reveals that "the key determinants of FDI inflows in the MENA countries are the size of the host economy, the government size, natural resources and the institutional variables. The external factors represented by global liquidity and trade variables show any significant effect on the determinants of FDI in the MENA countries." Mohamed and Sidiropoulos (2010) [52] Other study indicates that "foreign investors lament a lack of skills most. MENA countries score well below the Asian countries on 'people and skills availability'." (The World Bank, 2008) [53]

Consistent with the studies in the international literature, studies in the MENA region regarding the effectiveness of FDI in the MENA countries come to different and mixed results. For instance, some studies find strong potential for FDI for improving the international technology transfer in Egypt (Kadah, 2003). By contrast, other studies find several obstacles hinder FDI in Algeria. For instance, "the findings from the World Economic Forum Global Competitiveness Report (2003) indicate that the inappropriate and unstable investment climate and lack of FDI enabling environment in Algeria is due to lack of financing and credit facilities (23%), bureaucratic administration (14%), political instability (10%), restrictive regulations and legislation (8%), tax policy and spread of bribes (7%). This implies the importance of improving investment climate by removing FDI constraints and improving security and political stability in Algeria." (Zidan, 2004)[54] FDI is also impeded by "poor quality of institutions and governance on most measures of good governance and institutions, especially voice and accountability, regulatory quality, and control of corruption among MENA countries" (Abed and Davoodi, 2003) (Figure 2). [55]

FDI is hindered by poor competitiveness indicators in the MENA countries. The World Economic Forum (2011) Global Competitiveness Report (2011-2012) GCR (2011) illustrates several factors hampering competitiveness which can be used also to explain the factors hindering knowledge transfer in the MENA countries. These inhibiting factors are related to institutions, infrastructure, macroeconomic environment, higher education and training, goods market efficiency and labour market efficiency, market size, financial market development, technological readiness and innovation in the MENA countries (Figures 3-14). For instance, the impediment factors related to institutions are linked to the spread of irregular payments and bribes; weak efficiency of legal framework in challenging regulations, weak intellectual property protection and inadequate strength of investor protection in some MENA countries (Figures 15-18). The impediment factors related to technological readiness are linked to the weak technology absorption at firm level, weak

[51] See Moosa, I.A., and B.A. Cardak (2005), "The Determinants of Foreign Direct Investment in MENA Countries: An Extreme Bound Analysis," The 12 Annual Conference of the Economic Research Forum, Cairo, Economic Research Forum, 1-13, pp.1,7.

[52] See Sufian Eltayeb Mohamed and Moise G. Sidiropoulos (2010) "Another look at the determinants of foreign direct investment in MENA countries: an empirical investigation", *Journal of Economic Development*, Volume 35, Number 2, June 2010, pp. 75-95, 88-89**.** The Sample of MENA countries includes Algeria, Egypt, Jordan, Morocco, Syria, Tunisia, Bahrain, Kuwait, Oman, Qatar, Saudi Arab and, UAE.

[53] See the World Bank (2008)" Strengthening MENA's Trade and Investments Links with China and India," September 2, 2008, Document of the World Bank Social and Economic Development Group, Middle East and North Africa Region, pp. vii, xi.

[54] See Mohamed Zidan (2004) "Foreign direct investment in countries in transition - an analytical overview of the benefits and risks," *Journal of the Economies of North Africa* - the first edition, pp. 117-148. pp. 145-147. (In Arabic)

[55] See George T. Abed and Hamid R. Davoodi (2003) "Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund, pp. 10-11**.**

FDI and technology transfer and low proportion of Internet users (percentage of individuals using the Internet) in most MENA countries (Figures 19-21). The impediment factors related to infrastructure are linked to several factors such as the poor quality of overall infrastructure in the MENA countries (Figure 22). The impediment factors related to labour market efficiency are linked to poor flexibility of wage determination, the rigidity of employment, low reliance on professional management and brain drain in most MENA countries (Figures 23-26). The impediment factors related to goods market efficiency are linked to weak intensity of international competition (the global competitiveness index GCI), weak intensity of local competition, share of imports of goods and services as a percentage of gross domestic product, high extent and effect of taxation, the low prevalence of foreign ownership and weak business impact of rules on FDI in some MENA countries (Figures 27-34). The impediment factors related to market size are linked to small domestic market size index, small share of exports of goods and services as a percentage of gross domestic product, low gross domestic product and low gross domestic product per capita in most MENA countries (Figures 35-38). The impediment factors related to financial market development are linked to inadequate availability of financial services and venture capital in most MENA countries (Figures 39-40). The impediment factors related to business sophistication are linked to weak state of cluster development and weak value chain breadth in most MENA countries (Figures 41-42). The impediment factors related to higher education and training are linked to low tertiary education enrolment rate (gross tertiary education enrolment rate), low quality of the educational system, weak local availability of specialized research and training services and poor extent of staff training in most MENA countries (Figures 43-46). The impediment factors related to innovation are linked to limited capacity for innovation, weak government procurement of advanced technology products, low company spending on R&D and limited university-industry collaboration in R&D, poor quality of scientific research institutions and inadequate availability of scientists and engineers in most MENA countries (Figures 47-52).

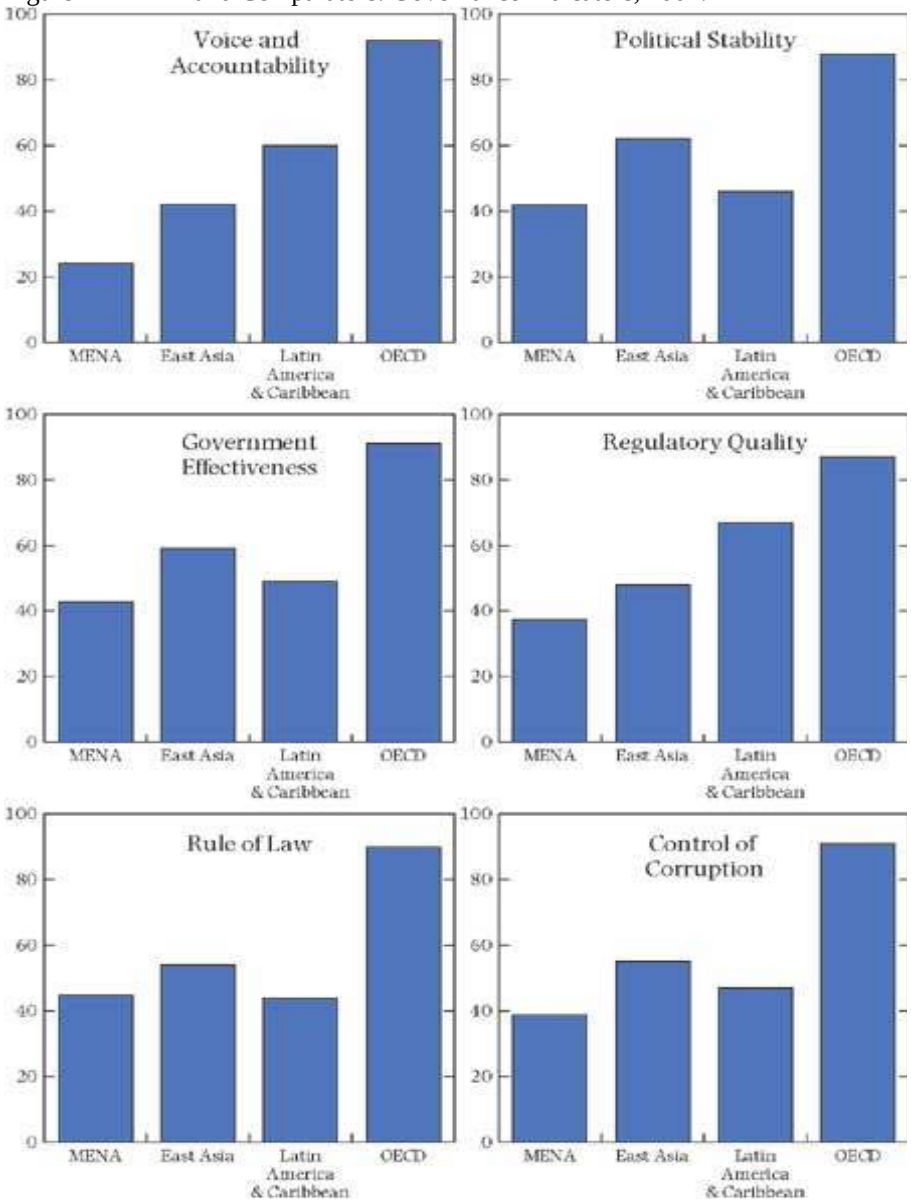
FDI is seriously impeded by restriction on foreign ownership and weakness in business environment in the Arab countries.[56] The private sector-led investment is hampered by macroeconomic policies, cumbersome business environment (average ranking of Arab Region by Doing Business in 2011: 102) with delays for start-up procedures, FDI restrictiveness in some sectors, low investment protection, labour market rigidities, impediments to access to financing, the large size of the public sector in the economy and prevalence of anti-competitive practices that hinder competitiveness and innovation. [57] The GCR (2011) shows the most problematic factors for doing business in selected MENA countries: Egypt, Jordan and Morocco (see Table 3, Figure 53). For instance, from the list of 15 factors, the six factors that had most represented the biggest

[56] See Sebastien Dessus, Julia Devlin and Raed Safadi (eds.) (2001) "Towards Arab and Euro-Med Regional Integration," OECD-WB-ERF, OECD, Paris, pp, 91-92, 102.

[57] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region," the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp. 3-4. See also the World Bank and the International Finance Corporation (2011) "Doing Business 2011 for Middle East & North Africa: Making a Difference for Entrepreneurs," www.doingbusiness.org.

problematic factors for doing business in Egypt are policy instability (13.6), inadequately educated workforce (13.4), access to financing (10.6), inefficient government bureaucracy (9.1), restrictive labour regulations (8.2) and corruption (7.3) respectively. While the six factors that had most represented the biggest problematic factors for doing business in Jordan are inefficient government bureaucracy (12.8), access to financing (12.6), tax rates (12.1), corruption (10.2), tax regulations (9.6) and poor work ethic in national labour force (9.1) respectively. Whereas the six factors that had most represented the biggest problematic factors for doing business in Morocco are access to financing (18.6), corruption (17.7), inadequate supply of infrastructure (11.6), inefficient government bureaucracy (10), tax rates (9.4) and tax regulations (9.3) respectively.[58]

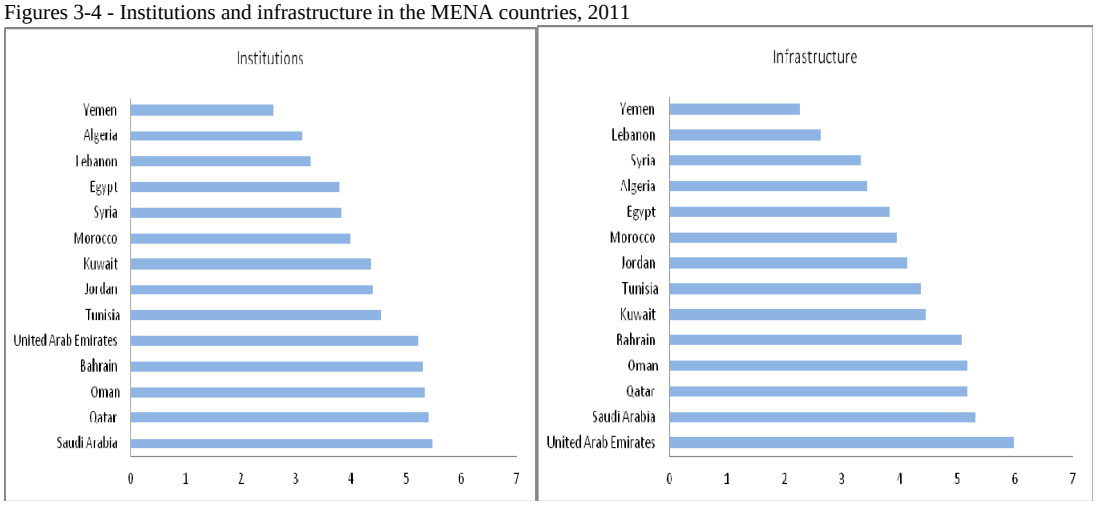
Figure 2- MENA and Comparators: Governance Indicators, 2002.



Sources: Kaufmann, Kraay, and Mastruzzi, 2003, cited in Abed and Davoodi, 2003, p. 12.

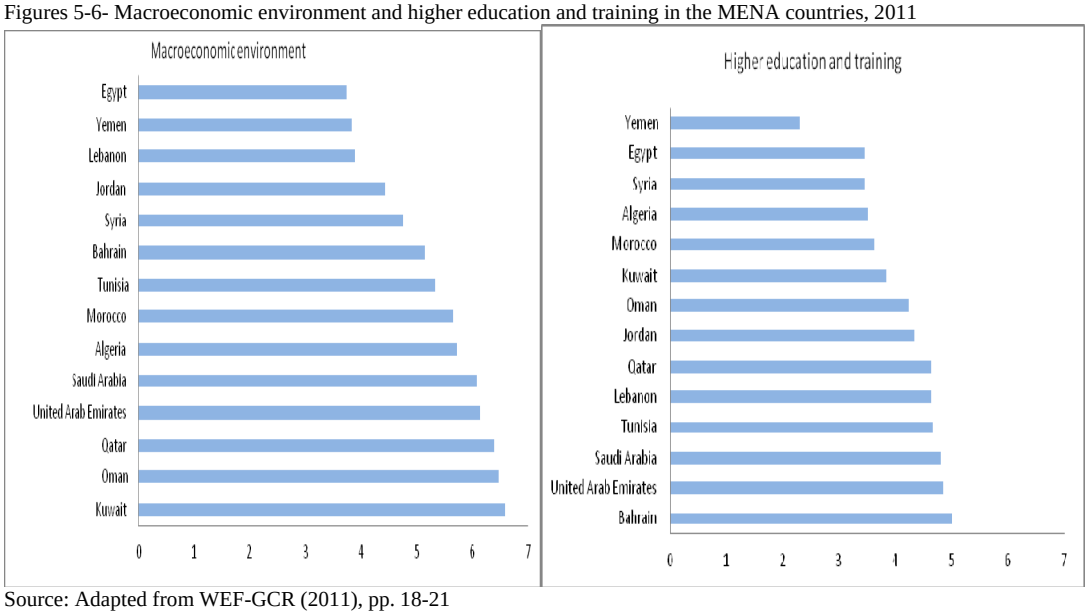
[58] This Figure summarizes those factors seen by business executives as the most problematic for doing business in their economy. The information is drawn from the 2011 edition of the World Economic Forum's Executive Opinion Survey. From a list of 15 factors, respondents were asked to select the five most problematic and rank them from 1 (most problematic) to 5. The results were then tabulated and weighted according to the ranking assigned by respondents. See GCR (2011), p. 89. See Klaus Schwab (ed.) (2011) "World Economic Forum (2011),the Global Competitiveness Report 2011-2012," Geneva, Switzerland, 2011.

Figures 3-4 - Institutions and infrastructure in the MENA countries, 2011



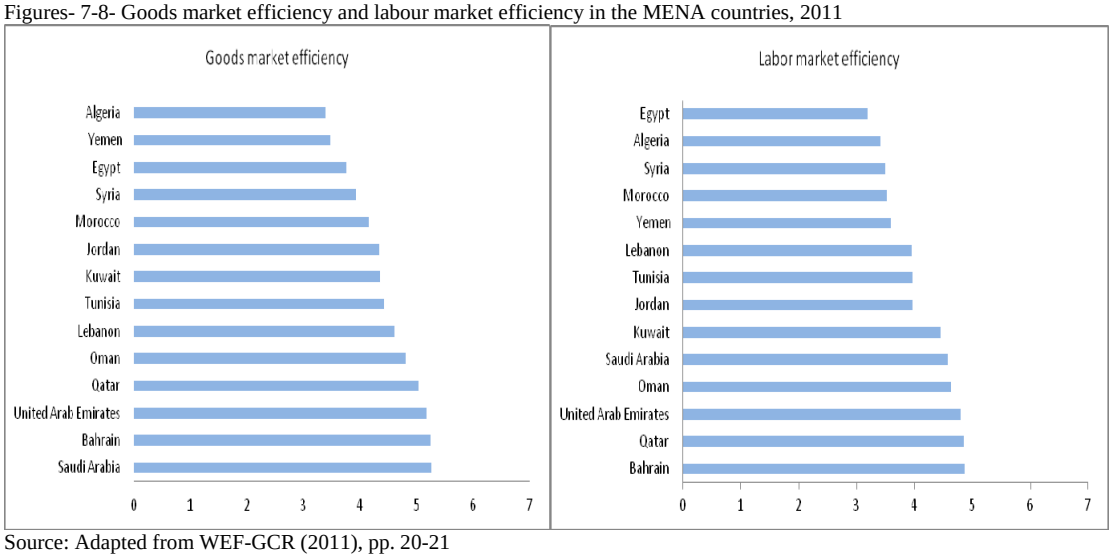
Source: Adapted from WEF-GCR (2011), pp. 18-19

Figures 5-6- Macroeconomic environment and higher education and training in the MENA countries, 2011



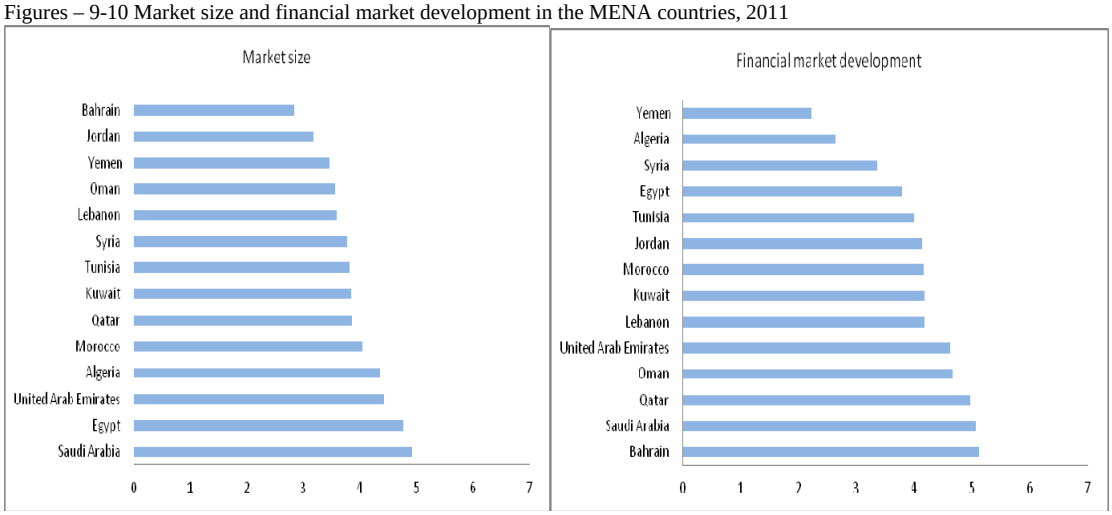
Source: Adapted from WEF-GCR (2011), pp. 18-21

Figures- 7-8- Goods market efficiency and labour market efficiency in the MENA countries, 2011



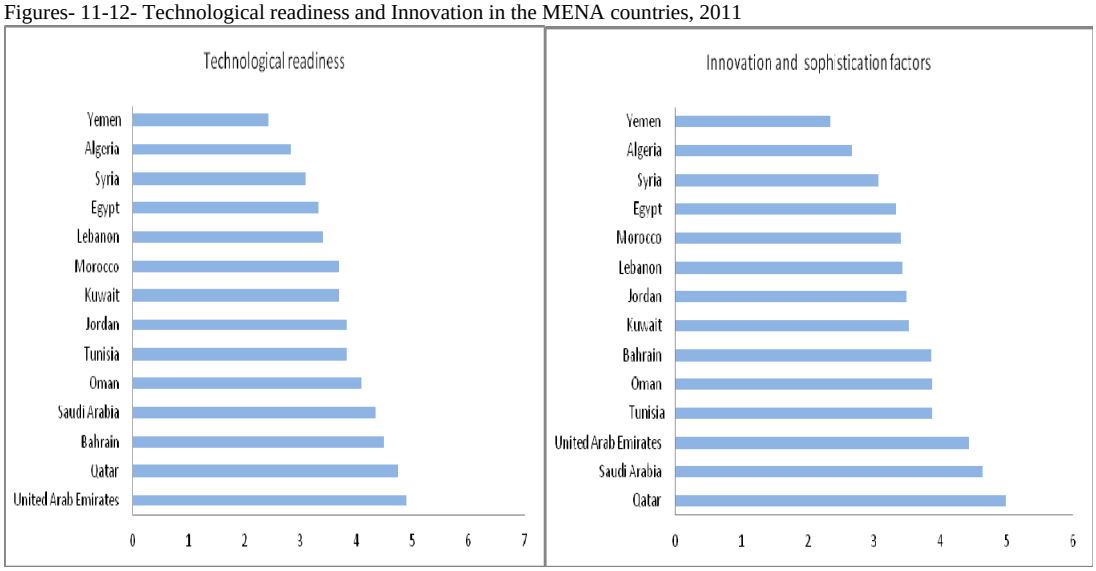
Source: Adapted from WEF-GCR (2011), pp. 20-21

Figures – 9-10 Market size and financial market development in the MENA countries, 2011



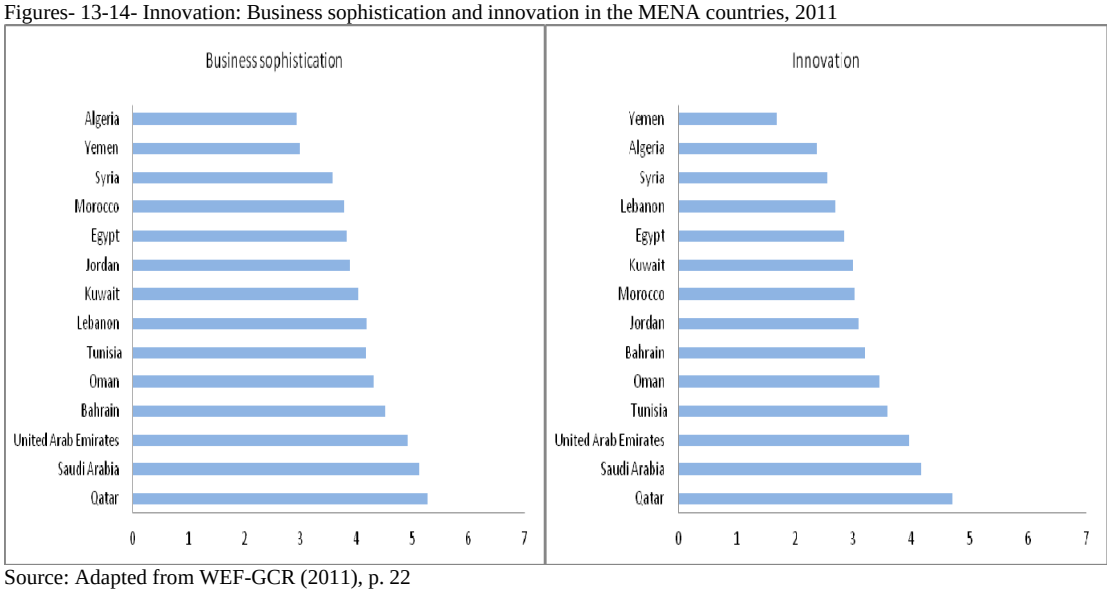
Source: Adapted from WEF-GCR (2011), pp. 20-21

Figures- 11-12- Technological readiness and Innovation in the MENA countries, 2011



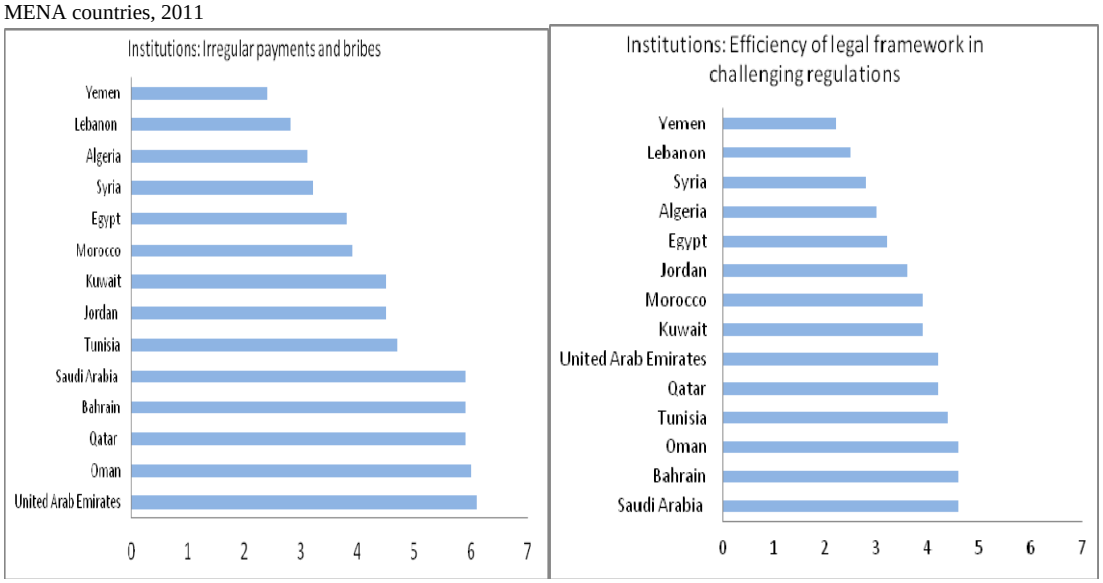
Source: Adapted from WEF-GCR (2011), pp. 20-22

Figures- 13-14- Innovation: Business sophistication and innovation in the MENA countries, 2011



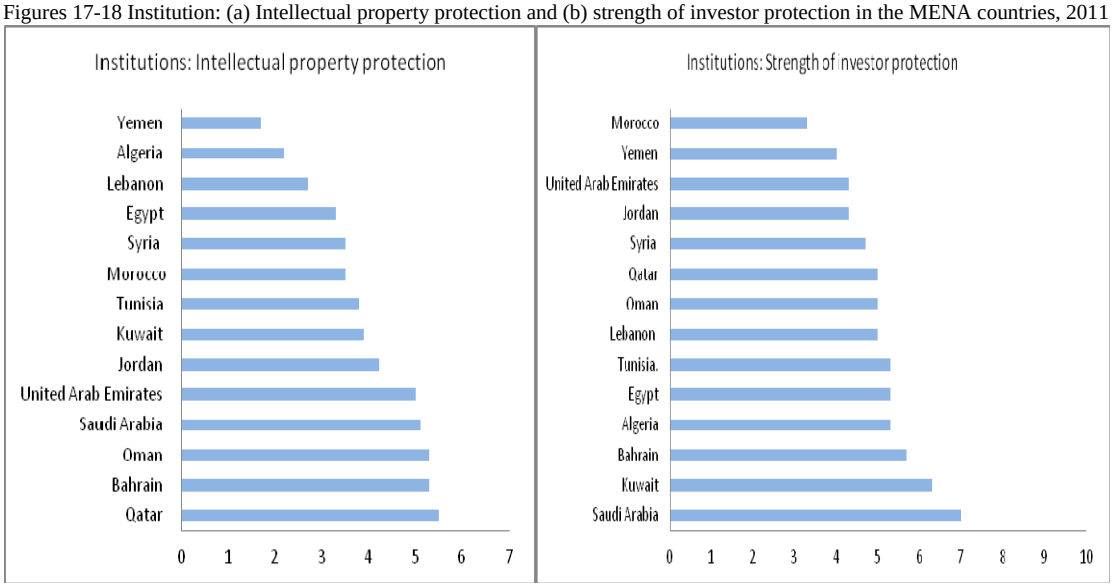
Source: Adapted from WEF-GCR (2011), p. 22

Figures-15-16-Institutions: Irregular payments and bribes and efficiency of legal framework in challenging regulations in the MENA countries, 2011



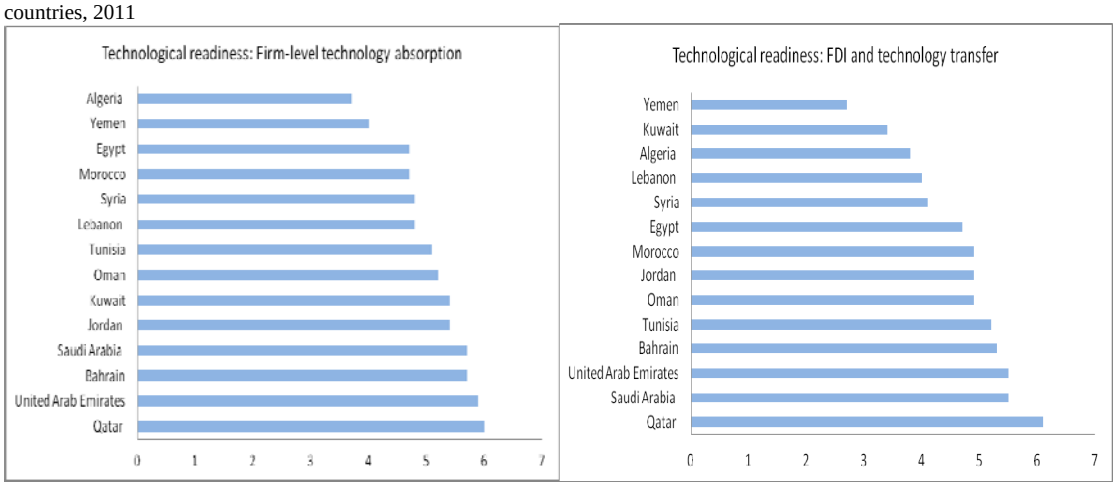
Source: Adapted from World Economic Forum, Executive Opinion Survey (WEF-EOS), cited in WEF-GCR (2011), pp. 394, 400

Figures 17-18 Institution: (a) Intellectual property protection and (b) strength of investor protection in the MENA countries, 2011



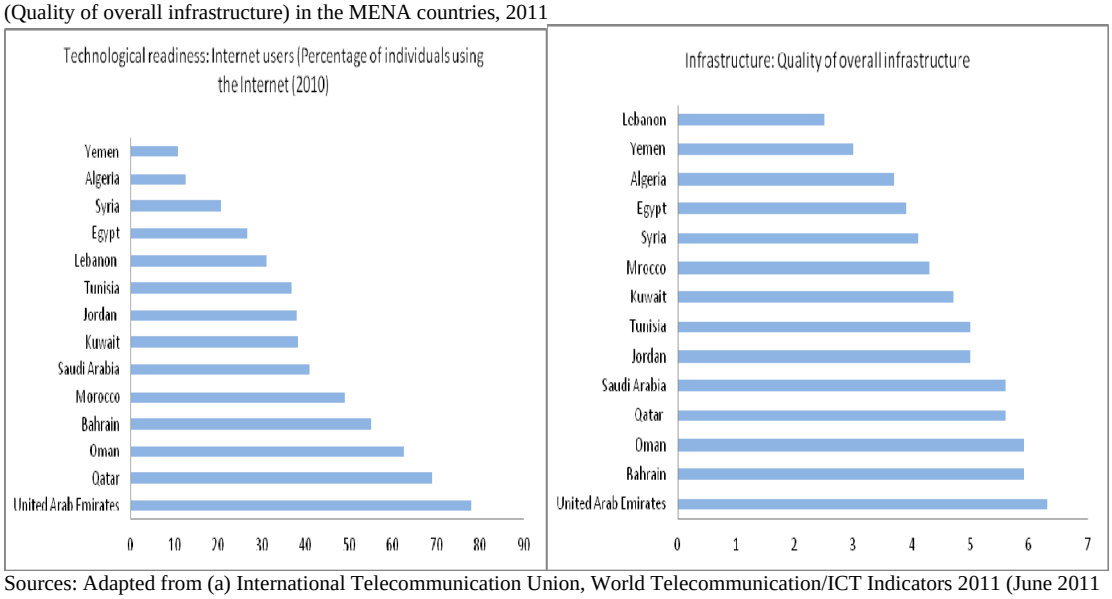
Sources: Adapted from (a) WEF-EOS, cited in GCR (2011), p.391, (b) World Bank/International Finance Corporation, Doing Business 2011: Making a Difference for Entrepreneurs, cited in GCR (2011), p.410.

Figures 19-20- Technological readiness: Firm-level technology absorption and FDI and technology transfer in the MENA countries, 2011



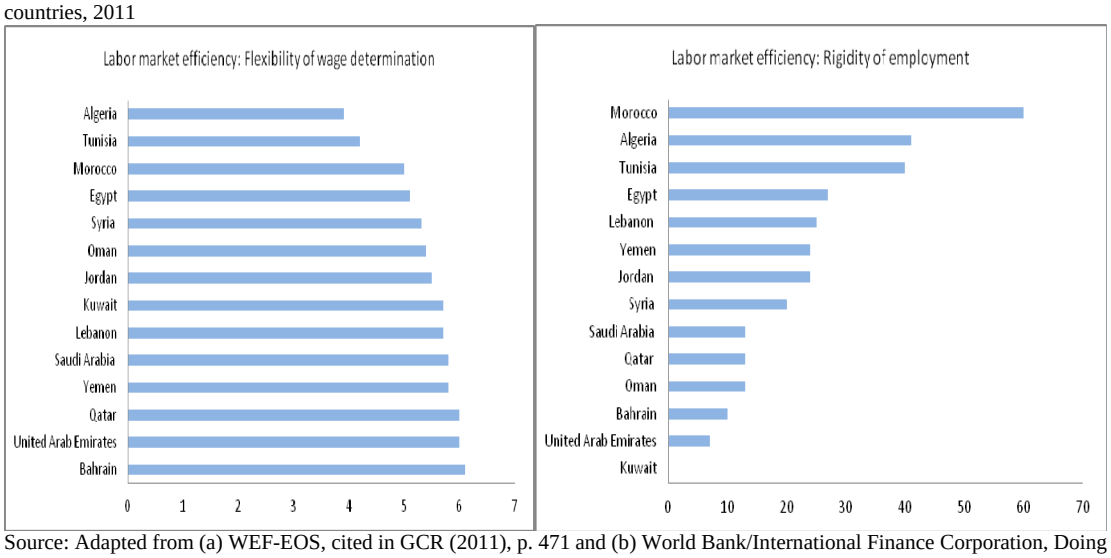
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 491-492.

Figures -21-22-Technological readiness: Internet users (Percentage of individuals using the Internet (2010) and Infrastructure (Quality of overall infrastructure) in the MENA countries, 2011



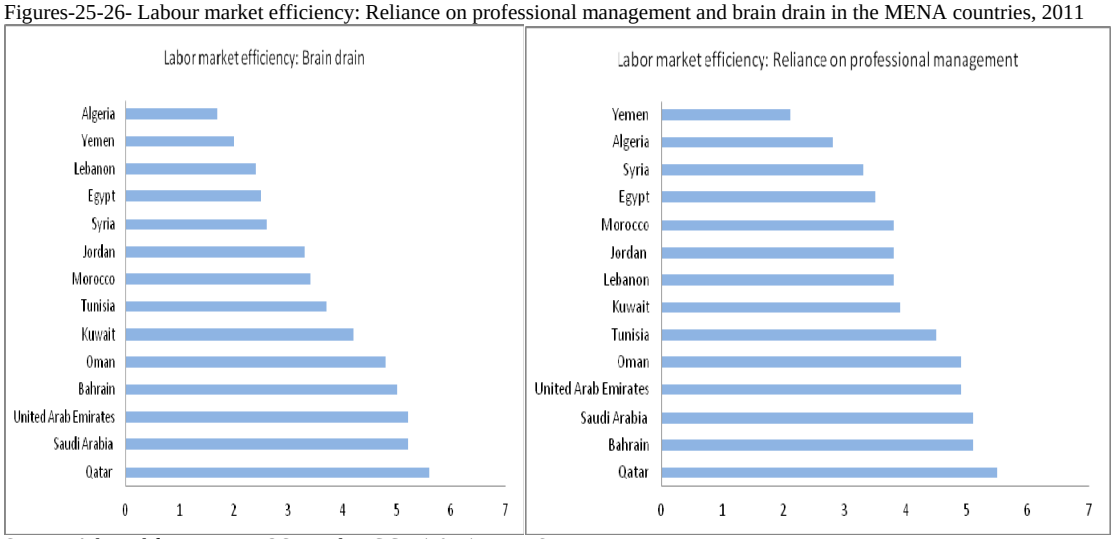
Sources: Adapted from (a) International Telecommunication Union, World Telecommunication/ICT Indicators 2011 (June 2011 edition), cited in GCR (2011), p. 493, (b) WEF-EOS, cited in GCR (2011), p. 412.

Figures-23-24- Labour market efficiency: (a) Flexibility of wage determination and (b) rigidity of employment in the MENA countries, 2011



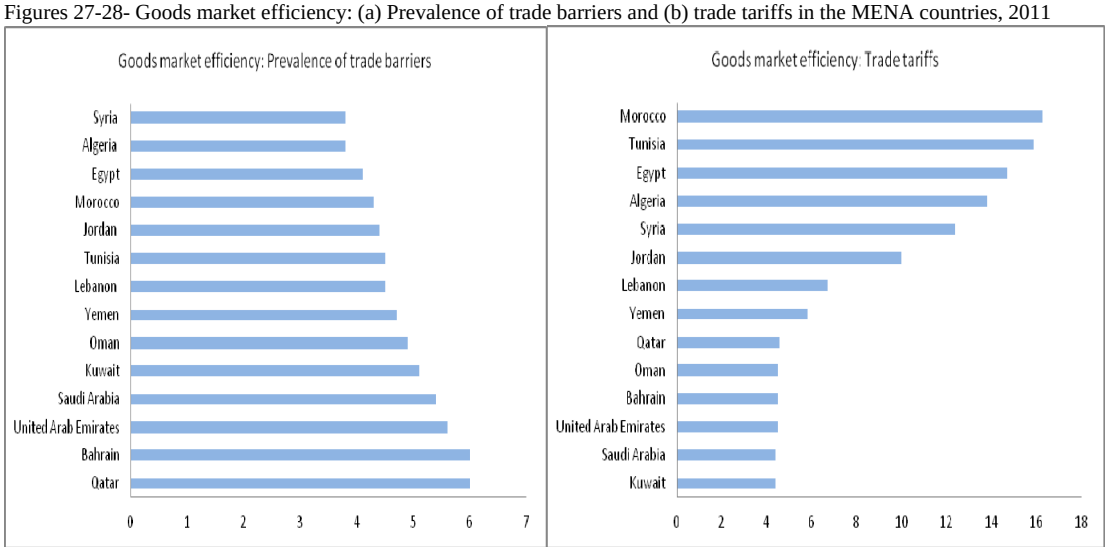
Source: Adapted from (a) WEF-EOS, cited in GCR (2011), p. 471 and (b) World Bank/International Finance Corporation, Doing Business 2010: Reforming Through Difficult Times, cited in GCR (2011), p. 472.

Figures-25-26- Labour market efficiency: Reliance on professional management and brain drain in the MENA countries, 2011



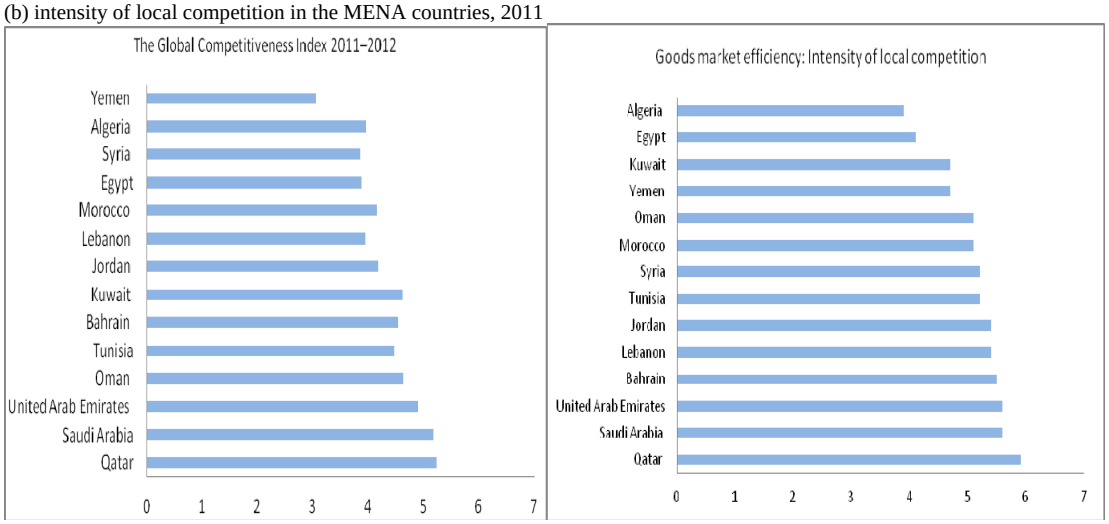
Source: Adapted from WEF-EOS, cited in GCR (2011), pp.476-477.

Figures 27-28- Goods market efficiency: (a) Prevalence of trade barriers and (b) trade tariffs in the MENA countries, 2011



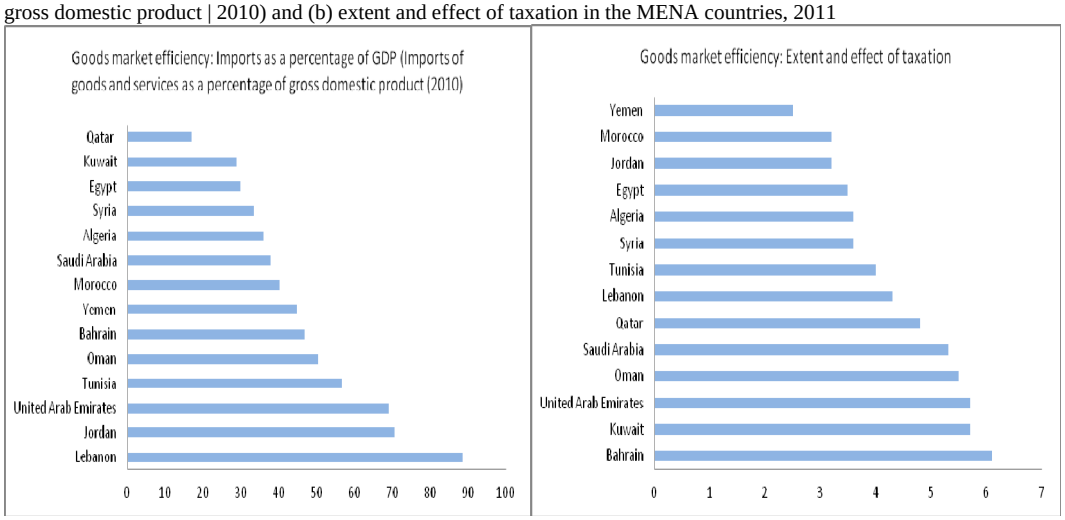
Source: Adapted from (a) WEF-EOS, cited in GCR (2011), p. 460, (b) International Trade Centre, cited in GCR (2011), p. 461.

Figures 29-30- Goods market efficiency: (a) intensity of international competition (the global competitiveness index GCI) and (b) intensity of local competition in the MENA countries, 2011



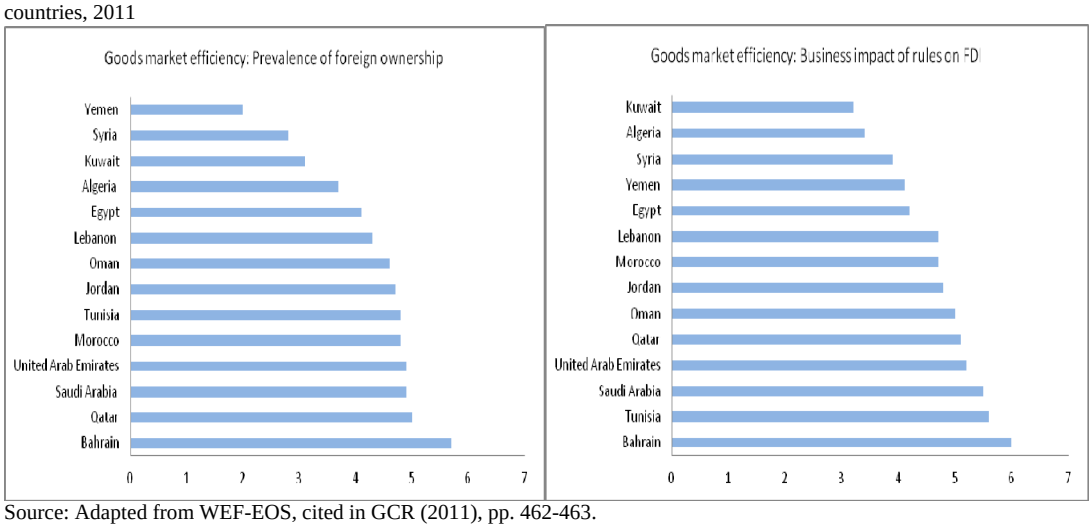
Source: Adapted from (a) GCR (2011), pp. 16-17 and (b) WEF-EOS, cited in GCR (2011), p.452.

Figures – 31-32- Goods market efficiency: (a) Imports as a percentage of GDP (Imports of goods and services as a percentage of gross domestic product | 2010) and (b) extent and effect of taxation in the MENA countries, 2011



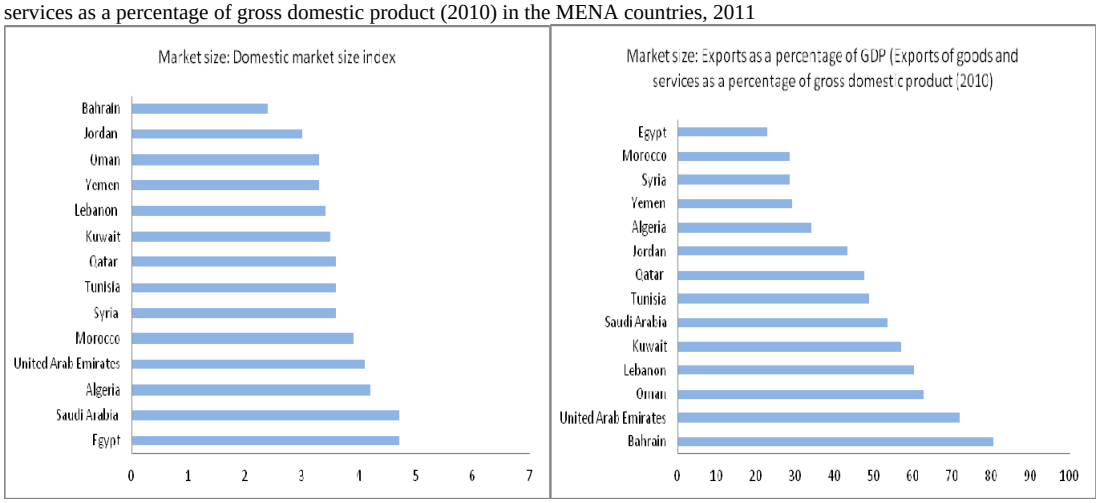
Source: Adapted from (a) World Trade Organization, Statistics Database: Time Series on International Trade (accessed July 4, 2011); Economist Intelligence Unit, Country Data Database (accessed July 4, 2011) cited in GCR (2011), p465and (b) WEF-EOS, cited in GCR (2011), p.455.

Figures – 33-34- Goods market efficiency: Prevalence of foreign ownership and business impact of rules on FDI in the MENA countries, 2011



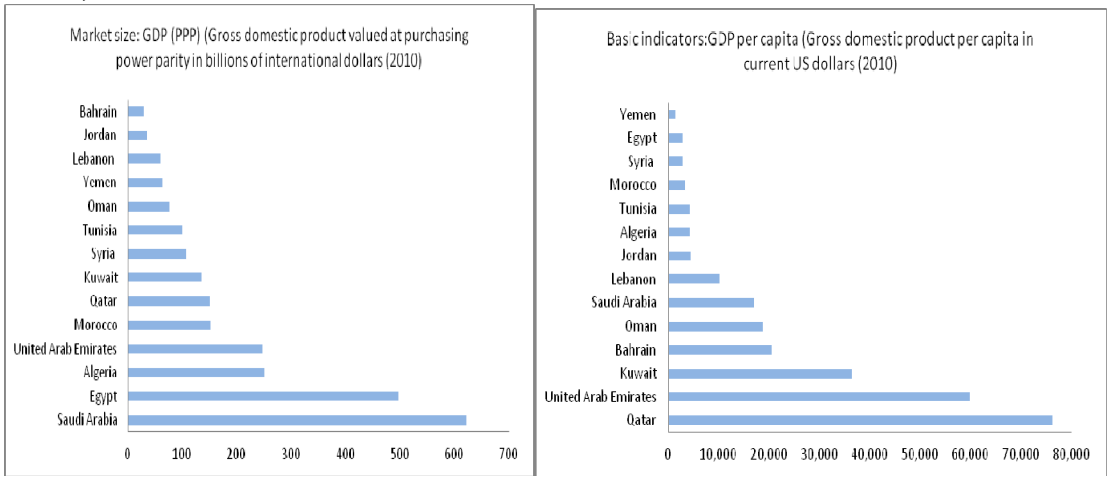
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 462-463.

Figures 35-36- Market size: (a) Domestic market size index and (b) exports as a percentage of GDP (exports of goods and services as a percentage of gross domestic product (2010) in the MENA countries, 2011



Source: Adapted from (a) Schwab (2011) cited in GCR (2011), p 498, and (b) World Trade Organization, Statistics Database: Time Series on International Trade (accessed July 4, 2011); Economist Intelligence Unit, Country Data Database (accessed July 4, 2011), cited in GCR (2011), p501.

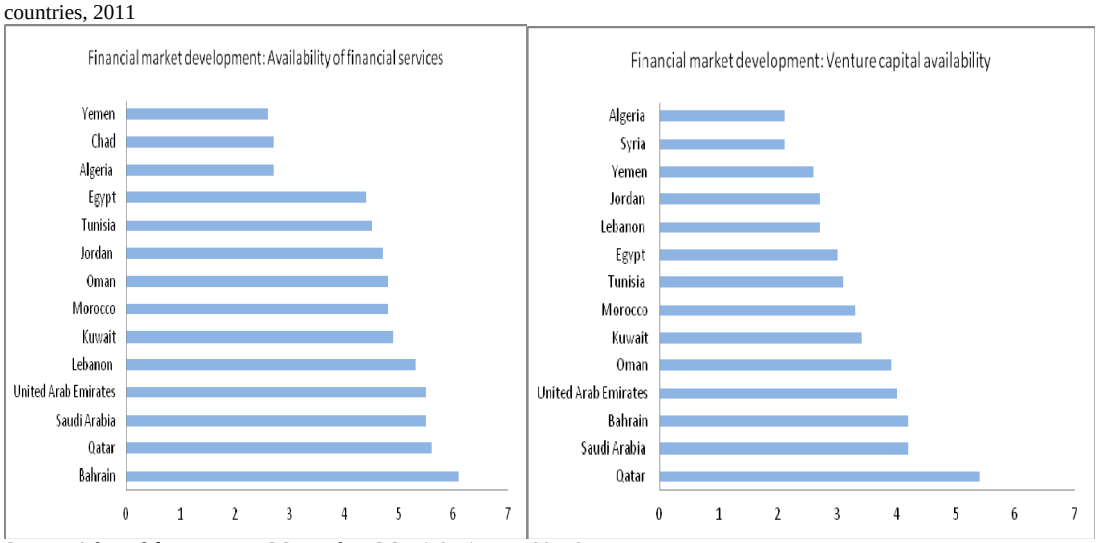
Figures 37-38- Market size and basic indicator: Gross domestic product (GDP) (PPP) and GDP per capita in the MENA countries, 2010[59]



Source: Adapted from International Monetary Fund, World Economic Outlook Database (April 2011 edition); national sources, cited in GCR (2011), pp. 499, 386.

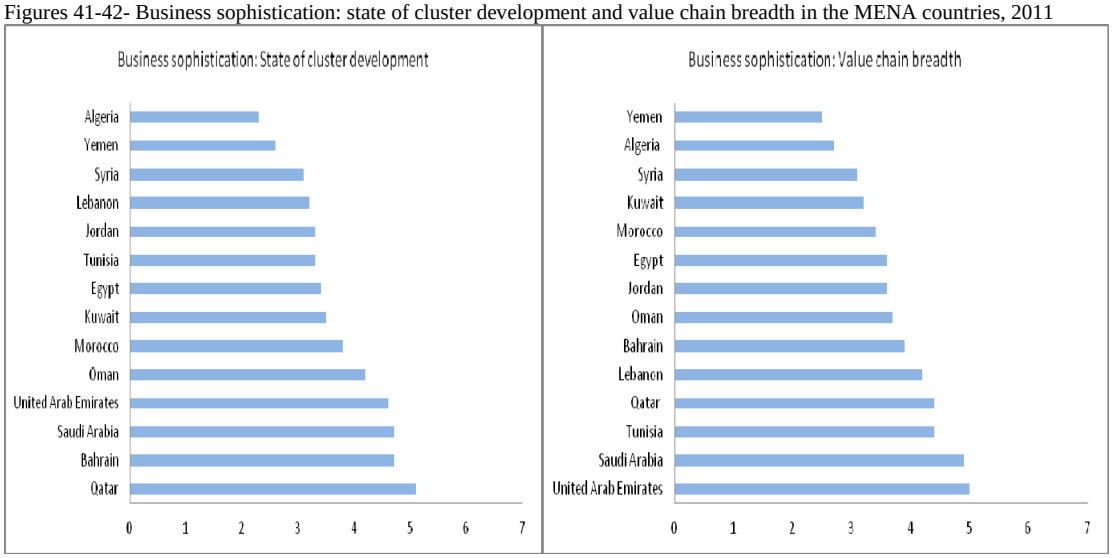
[59] Gross domestic product ((PPP) valued at purchasing power parity in billions of international dollars and Gross domestic product per capita valued in current US dollars.

Figures 39-40: Financial market development: Availability of financial services and venture capital availability in the MENA countries, 2011



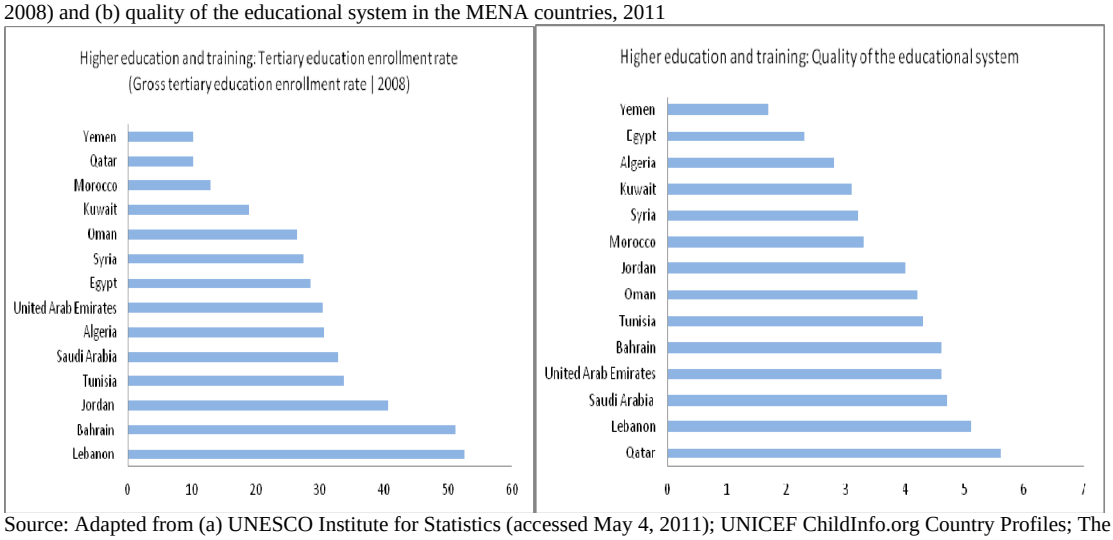
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 480, 484.

Figures 41-42- Business sophistication: state of cluster development and value chain breadth in the MENA countries, 2011



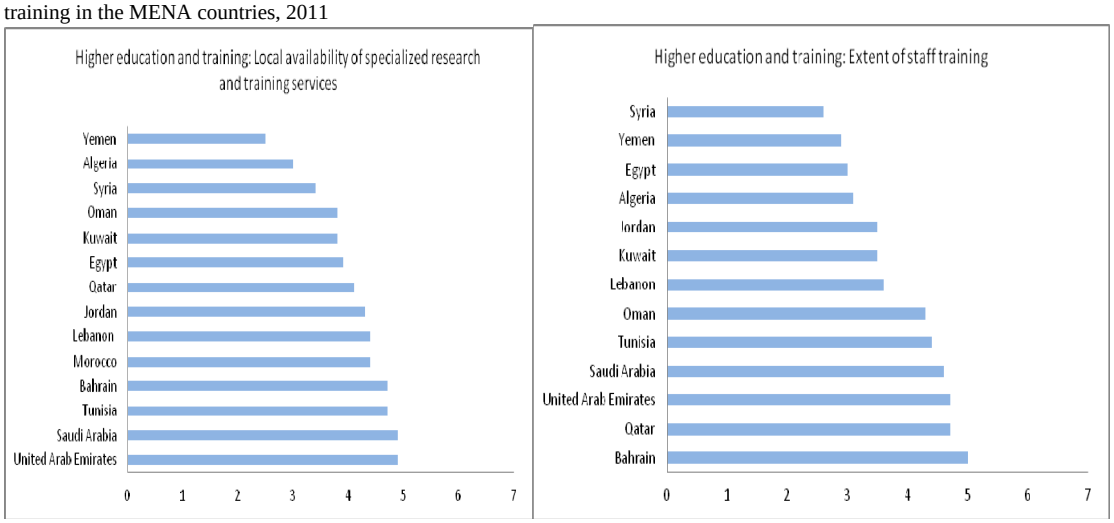
Source: Adapted from WEF-EOS, cited in GCR (2011), p506, 508.

Figures 43-44- Higher education and training: (a) Tertiary education enrolment rate (Gross tertiary education enrolment rate 2008) and (b) quality of the educational system in the MENA countries, 2011



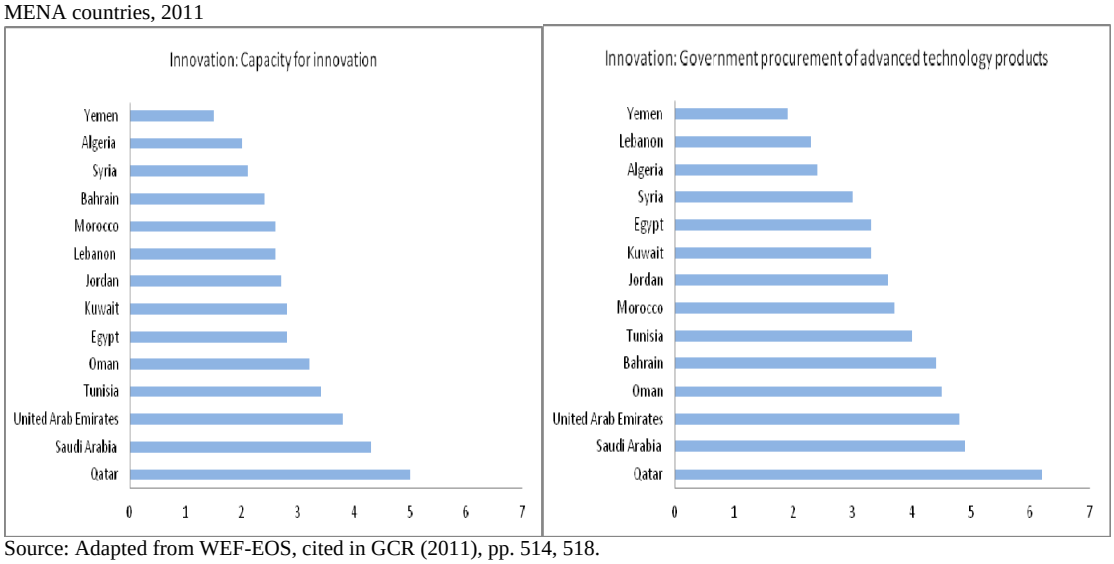
Source: Adapted from (a) UNESCO Institute for Statistics (accessed May 4, 2011); UNICEF ChildInfo.org Country Profiles; The World Bank, EdStats Database(accessed July 8, 2011); national sources and The World Development Indicators 2009 (CD-Rom edition), cited in GCR (2011), p 443 (b) WEF-EOS, cited in GCR (2011), p444.

Figures 45-46 - Higher education and training: local availability of specialized research and training services and extent of staff training in the MENA countries, 2011



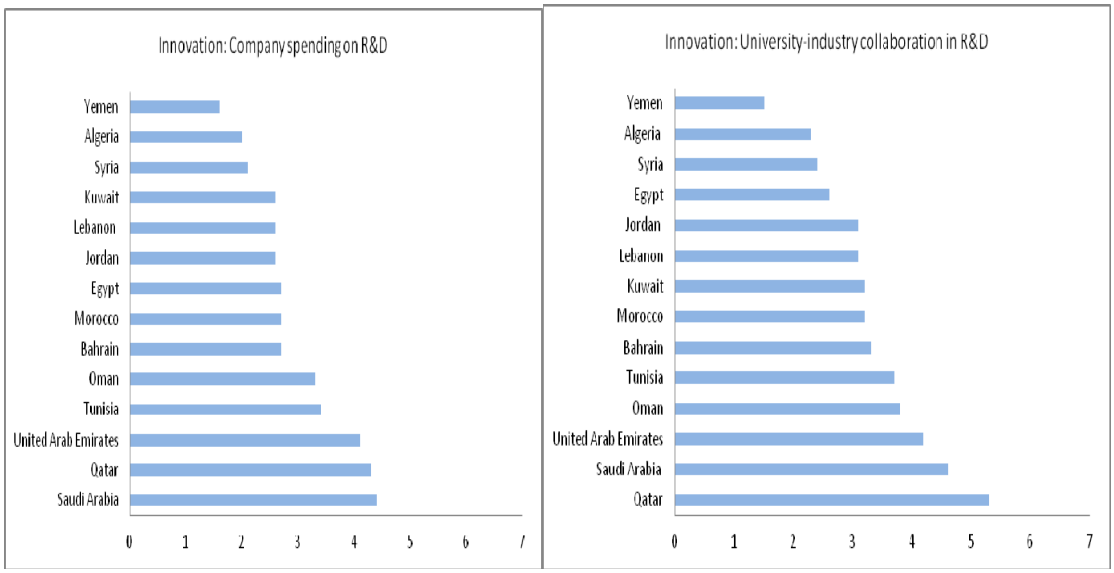
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 448-449.

Figures 47-48 - Innovation: Capacity for innovation and government procurement of advanced technology products in the MENA countries, 2011



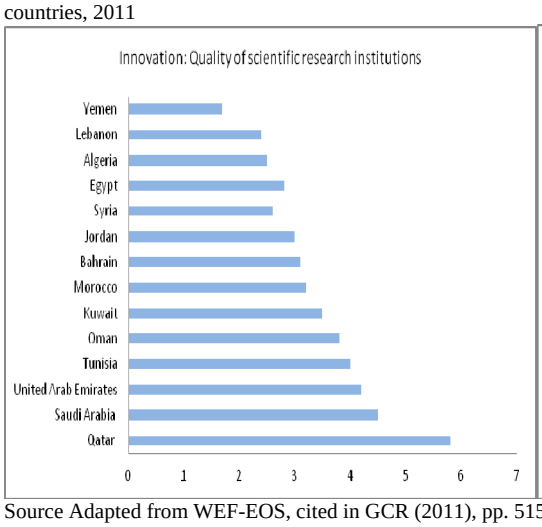
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 514, 518.

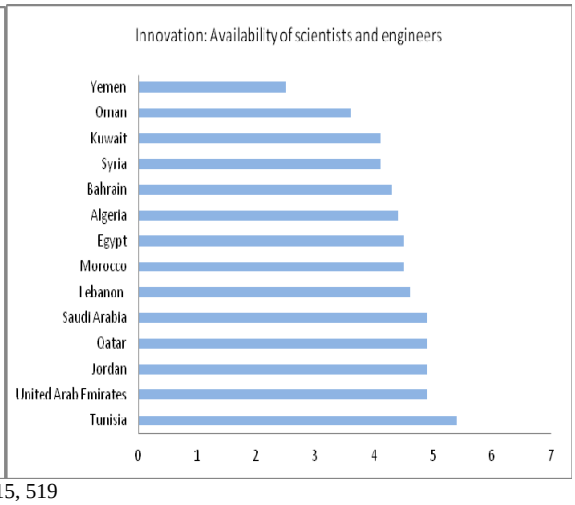
Figures 49-50 - Innovation: Company spending on R&D and University-industry collaboration in R&D in the MENA countries, 2011



Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 516-517

Figures 51-52-Innovation: Quality of scientific research institutions and availability of scientists and engineers in the MENA countries, 2011

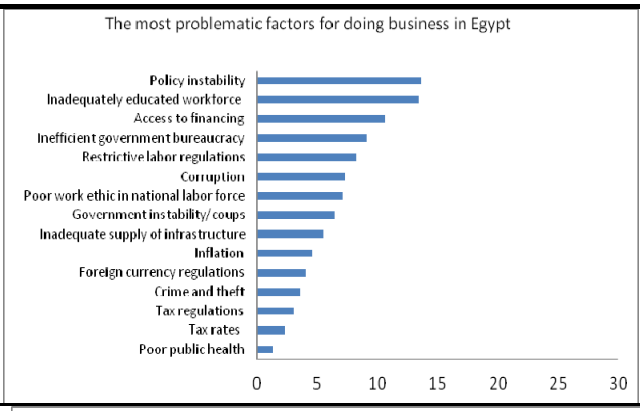




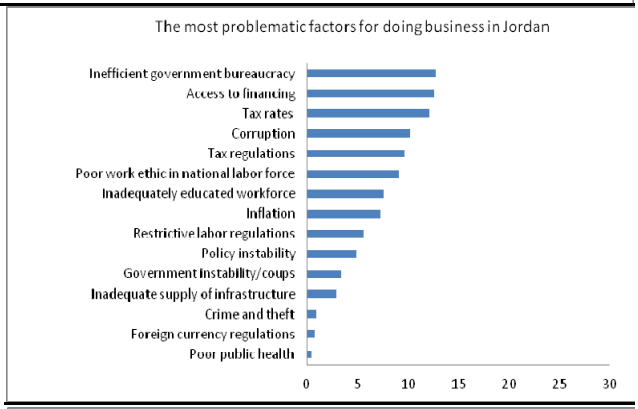
Source Adapted from WEF-EOS, cited in GCR (2011), pp. 515, 519

Table 3- Figure 53- The most problematic factors for doing business in selected MENA countries: Egypt, Jordan and Morocco 2011

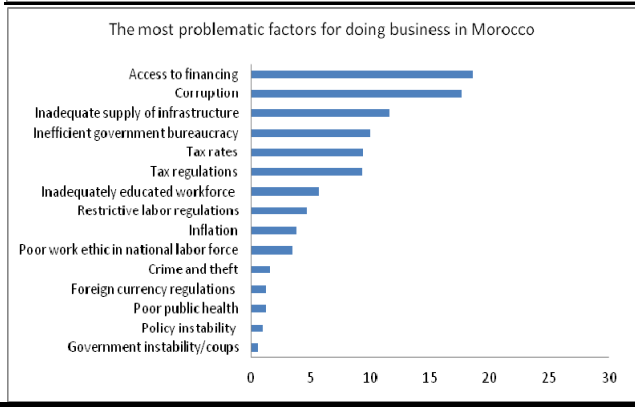
(a) Egypt	
Policy instability	13.6
Inadequately educated workforce	13.4
Access to financing	10.6
Inefficient government bureaucracy	9.1
Restrictive labour regulations	8.2
Corruption	7.3
Poor work ethic in national labour force	7.1
Government instability/coups	6.4
Inadequate supply of infrastructure	5.5
Inflation	4.6
Foreign currency regulations	4
Crime and theft	3.6
Tax regulations	3
Tax rates	2.3
Poor public health	1.3



(b) Jordan	
Inefficient government bureaucracy	12.8
Access to financing	12.6
Tax rates	12.1
Corruption	10.2
Tax regulations	9.6
Poor work ethic in national labour force	9.1
Inadequately educated workforce	7.5
Inflation	7.3
Restrictive labour regulations	5.6
Policy instability	4.9
Government instability/coups	3.4
Inadequate supply of infrastructure	2.9
Crime and theft	0.9
Foreign currency regulations	0.7
Poor public health	0.4



(c) Morocco	
Access to financing	18.6
Corruption	17.7
Inadequate supply of infrastructure	11.6
Inefficient government bureaucracy	10
Tax rates	9.4
Tax regulations	9.3
Inadequately educated workforce	5.7
Restrictive labour regulations	4.7
Inflation	3.8
Poor work ethic in national labour force	3.5
Crime and theft	1.6
Foreign currency regulations	1.3
Poor public health	1.3
Policy instability	1
Government instability/coups	0.6

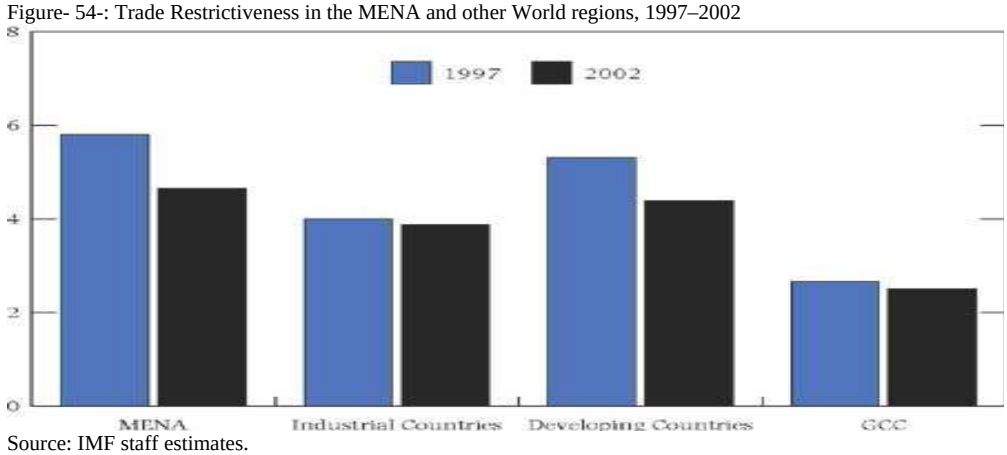


Source: GCR (2011), pp. 168, 220, 266.

3. 2. *Factors enable /impede international trade in the MENA countries*

Several studies in the MENA region discuss the factors that hampered the international trade, which is important channel of knowledge transfer. For instance, the literature indicates that "the MENA region's liberalization and trade performance (share in world export market) is below that of other regions. ….. there is a dichotomy in trade regimes. Many countries, including the GCC members, Yemen, and Mauritania, and, to a lesser extent and more recently, Algeria and Jordan, are generally open to free trade. However, the remaining countries, despite recent trade liberalization efforts, such as in Morocco, and Tunisia continue to maintain relatively high tariffs and nontariff barriers. As a result, for the MENA region as a whole, the overall degree of trade restrictiveness, as measured by an index developed by the IMF staff, is above that of other regions in the world, although it has improved over the last six years (Figure 54). In terms of nontariff barriers, MENA countries are not that different from developing countries as a group, (Figure 54)." (Abed and Davoodi, 2003)[60] Moreover, the trade restrictiveness in the MENA countries is also obvious from the high prevalence of trade barriers in Syria, Algeria, Egypt, Morocco, Jordan, Tunisia and Lebanon, from the high prevalence of trade tariffs in Morocco, Tunisia, Egypt, Algeria, Syria, Jordan and Lebanon (Figures 55-56), and from the low trade performance as measured by the imports and exports as percentages of GDP in the MENA region (Figures 57-58). The region has made progress in terms of international trade liberalization (openness ratio 76.4% of GDP while the world average is 42.8%) but remains relatively closed (having the highest overall trade restrictiveness index among regions, the non-tariff measures having a significant effect) and marginalized in world trade excluding oil (less than 1% of world exports). Moreover, trade is hindered by the lack of facilitation (28 days for customs procedures against 12 days in OECD) and by mediocre transport infrastructures and logistics performances (the latter's index is one point below the OECD average).[61]

Figure- 54-: Trade Restrictiveness in the MENA and other World regions, 1997–2002

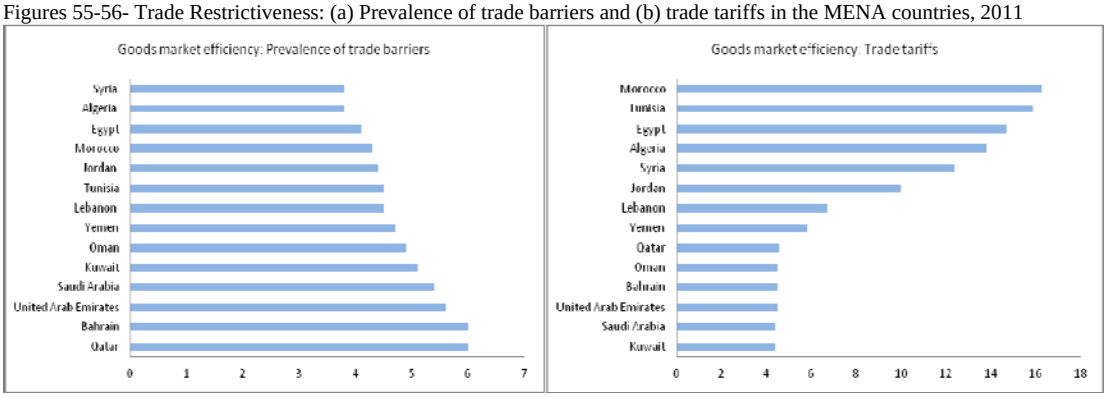


Source: IMF staff estimates.
Note: Scale is 1–10, with 10 being most restrictive.

[60] See George T. Abed and Hamid R. Davoodi (2003)"Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund pp. 7, 21-22.

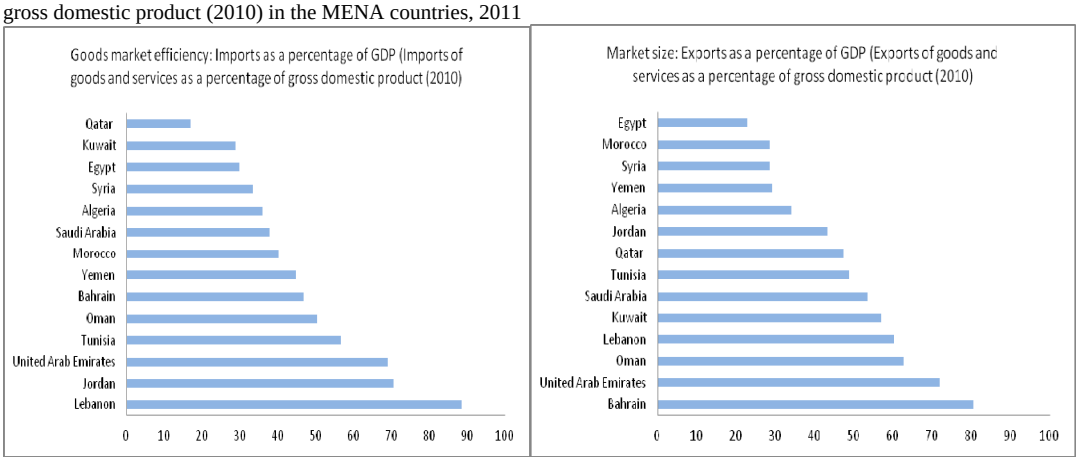
[61] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region" the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp. 3.-4.

Figures 55-56- Trade Restrictiveness: (a) Prevalence of trade barriers and (b) trade tariffs in the MENA countries, 2011



Source: Adapted from (a) WEF-EOS, cited in GCR (2011), p. 460, (b) International Trade Centre, cited in GCR (2011), p. 461

Figures – 57-58-Trade: Imports and exports as percentages of GDP (Imports and exports of goods and services as percentages of gross domestic product (2010) in the MENA countries, 2011



Source: Adapted from World Trade Organization, Statistics Database: Time Series on International Trade (accessed July 4, 2011); Economist Intelligence Unit, Country Data Database (accessed July 4, 2011), cited in GCR (2011), pp. 465, 501.

3. 3. *Factors enable /impede ICT in the MENA countries*

Several studies in the MENA region discuss the diffusion and impact of ICT in the MENA countries (Tsang, Yaqub, van Welsum, Thompson-Starkey and Chataway, 2011), and explore the factors that hampered ICT diffusion, which is important channel of knowledge transfer.[62] Although access to ICT has grown rapidly in the MENA region but the information and technology links, broadband infrastructure and the use of ICT remained insufficient and low by international standards.[63] Some studies in the literature "indicate that [in most MENA countries] implementation of [ICT] policies and strategies is proceeding at a moderate pace, because of bureaucracy (Kuwait and Saudi Arabia), insufficient resources (Egypt and Jordan) and limited access to public domain information, sometimes due to censorship." (ESCWA report, 2009) [64]

The World Economic Forum (2011) the Global Information Technology Report (GITR) (2010–2011) explains the poor performance of several MENA countries and poor performance of

[62] See Flavia Tsang, Ohid Yaqub, Desirée van Welsum, Tony Thompson-Starkey, Joanna Chataway (2011) "The impact of information and communication technologies in the Middle East and North Africa," TR-1163-WB, September 2011, the World Bank, RAND Europe, Cambridge, United Kingdom.

[63] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region" the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp. 3.-4

[64] See ESCWA (2009) "Regional Profile of the Information Society in Western Asia," pp. 11-12, 44-45, 66-67, 77. http://s3.amazonaws.com/zanran_storage/www.escwa.un.org/ContentPages/50236214.pdf. ESCWA report (2009) indicates that Saudi Arabia could have been ranked in a higher maturity level were it not for its strict censorship and filtering policies.

average MENA region that falls below the world average in terms of ICT, Networked Readiness Index (NRI) and NRI component sub-indexes: environment (political and regulatory, market and infrastructure), readiness by business and government and usage by individual, business and government, specially business usage (Table 4).[65] It is worthy to note the considerable variation across the MENA countries in terms of ICT, NRI, (Figures 59-66), for instance, in terms of NRI, environment component sub-index, readiness and usage, the figures illustrate better performance for all the GCC countries compared to other MENA countries, with the exception of Jordan, which made it to the top 50 countries globally on the environment sub-index component.[66]

Table 4- The NRI 2010–2011 heat map for selected economies and country groups

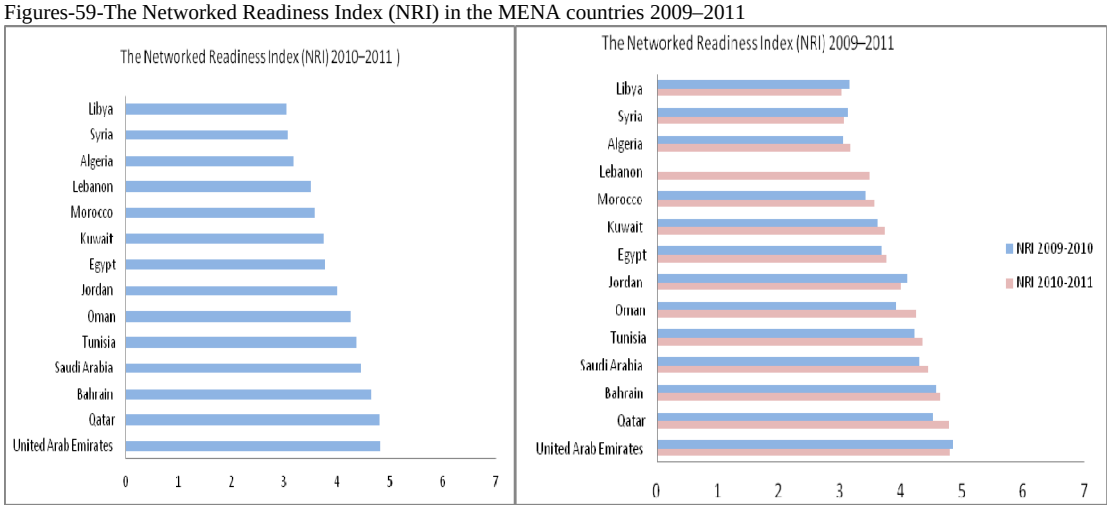
	Networked Readiness Index	Political and regulatory environment	Market environment	Infra-structure environment	Individual readiness	Business readiness	Government readiness	Individual usage	Business usage	Government usage
Income groups										
High income	4.7	4.7	5.1	4.7	5.2	4.6	4.6	5.1	3.9	4.4
Upper middle income	3.7	4	3.9	3.4	4.8	3.9	3.9	3.5	3	3.4
Lower middle income	3.5	3.8	3.6	2.9	4.6	3.7	3.8	2.8	2.9	3.1
Low income	3.2	3.6	3.6	2.4	4	3.6	3.8	2.2	2.5	2.8
Regions (low- and middle-income economies only)										
East Asia & Pacific	3.8	4.1	3.9	3	4.8	3.9	4.3	3.1	3.3	3.5
Europe & Central Asia	3.6	3.8	3.6	3.4	4.9	3.6	3.7	3.5	2.8	3.2
MENA	3.5	3.8	3.7	3.2	4.9	3.6	3.9	3	2.7	3.2
South Asia	3.5	4.1	3.5	2.7	5	3.8	4	2.4	2.9	3.2
Sub-Saharan Africa	3.3	3.7	3.8	2.5	3.9	3.7	3.9	2.3	2.6	2.8
Average (138 econ.)	3.9	4.2	4.2	3.5	4.8	4	4.1	3.7	3.2	3.6

Source: World Economic Forum (2011) The Global Information Technology Report 2010–2011, Table 6, p. 20.

[65] According to the World Economic Forum and INSEAD (2011) The Global Information Technology Report (GITR) (2010–2011) the Networked Readiness Index (NRI), has been used for measuring the degree to which developed and developing countries across the world leverage information and communication technologies (ICT) for enhanced competitiveness. It has been helping policymakers and relevant societal stakeholders to track their economies' strengths and weaknesses as well as their progress over time, to identify best practices in networked readiness worldwide, and to design roadmaps and strategies toward optimal ICT diffusion. The networked readiness framework translates into the NRI, comprising three sub-indexes that measure the environment for ICT, together with the main stakeholders' readiness and usage, with a total of nine pillars and 71 variables as follows: First, the environment component sub-index of NRI used in the GITR 2010-2011 measures the openness of a country's environment for ICT development by taking into consideration three main pillars, namely: (a) the market environment pillar, which measures the ICT conduciveness of the business environment in a country; (b) the political and regulatory pillar, which measures the quality of the national legal framework with particular regard to ICT development; and (c) the infrastructure pillar, which measures the extent to which national infrastructure encourages ICT development and diffusion. Second, the readiness component sub-index of NRI used in the GITR 2010-2011 measures the individual readiness; business readiness and government readiness. Third, the usage component sub-index of NRI used in the GITR 2010-2011 measures the individual usage; business usage and government usage. The final NRI score is a simple average of the three composing sub-index scores, while each sub-index's score is a simple average of those of the composing pillars. See World Economic Forum (2011) The Global Information Technology Report 2010–2011, pp. 3, 6.

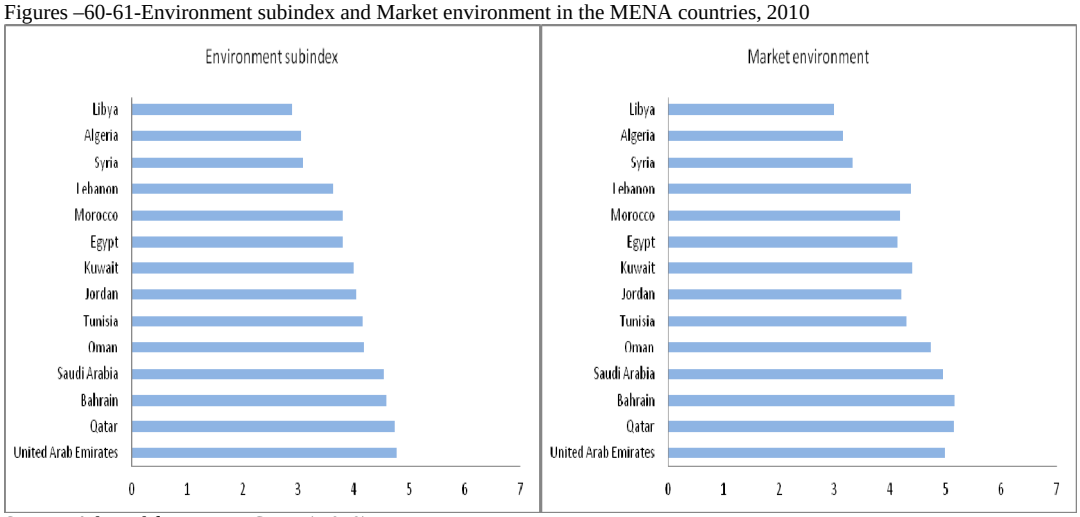
[66] Tsang, Yaqub, van Welsum, Thompson-Starkey and Chataway (2011) find that the level of ICT diffusion varies greatly among the MENA countries. For example, the number of Internet users ranges from around one per 100 inhabitants in Iraq and Somalia to seventy-five in UAE. The case of mobile cellular subscriptions is even more extreme: in Somalia there were only seven mobile cellular subscriptions per 100 inhabitants, but in seven other MENA countries (UAE, Bahrain, Qatar, Saudi Arabia, Libya, Oman and Kuwait) mobile cellular subscriptions exceeded 100 percent. See Flavia Tsang, Ohid Yaqub, Desirée van Welsum, Tony Thompson-Starkey, Joanna Chataway (2011) "The impact of information and communication technologies in the Middle East and North Africa," TR-1163-WB, September 2011, the World Bank, RAND Europe, Cambridge, United Kingdomp. p. 18.

Figures-59-The Networked Readiness Index (NRI) in the MENA countries 2009–2011



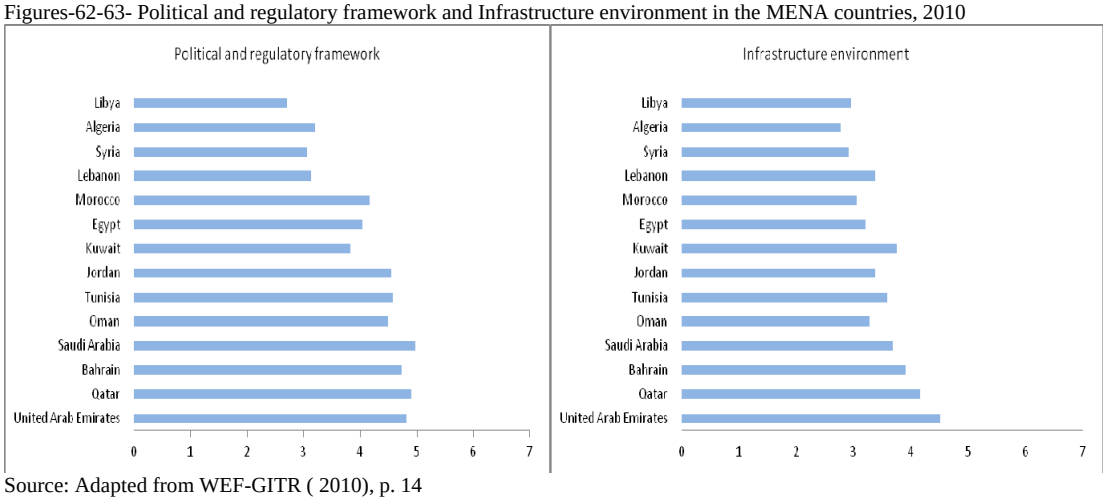
Source: Adapted from WEF-GITR (2010), pp. 12-13

Figures –60-61-Environment subindex and Market environment in the MENA countries, 2010



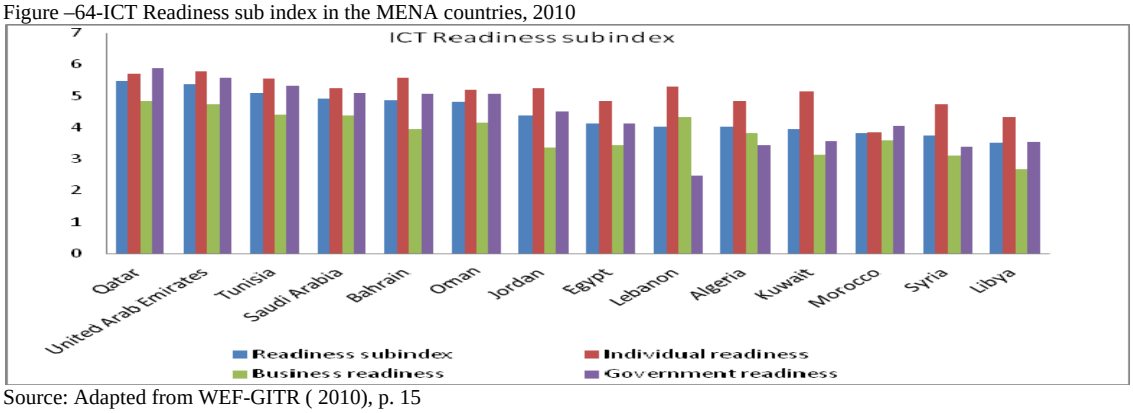
Source: Adapted from WEF-GITR (2010), p. 14

Figures-62-63- Political and regulatory framework and Infrastructure environment in the MENA countries, 2010



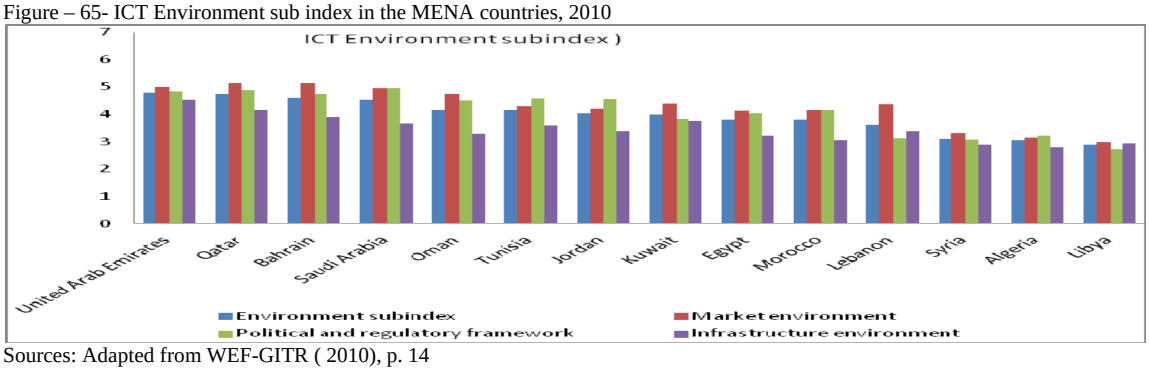
Source: Adapted from WEF-GITR (2010), p. 14

Figure –64-ICT Readiness sub index in the MENA countries, 2010



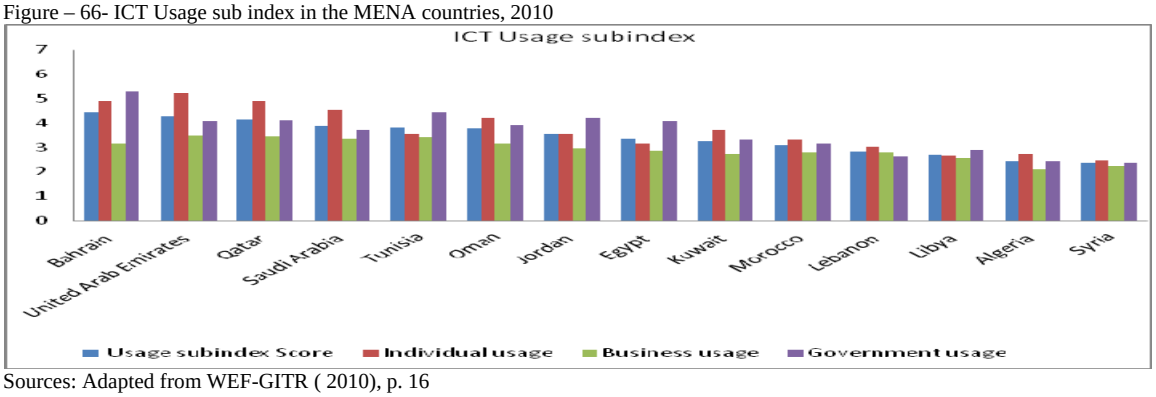
Source: Adapted from WEF-GITR (2010), p. 15

Figure – 65- ICT Environment sub index in the MENA countries, 2010



Sources: Adapted from WEF-GITR (2010), p. 14

Figure – 66- ICT Usage sub index in the MENA countries, 2010



Sources: Adapted from WEF-GITR (2010), p. 16

3. 4. *Factors enable /impede education and human capital mobility in the MENA countries*

Numerous studies in the MENA region discuss the factors that hampered education and human capital mobility, which are important channels of knowledge transfer. Knowledge transfer through utilization of human capital and education in the MENA region is immensely impeded by the poor quality of education, the high incidence of skill gap, mismatch and brain drain. For instance, the results from several studies in the literature imply that knowledge transfer through utilization of education and human capital in the MENA region is extremely impeded by the poor quality of education (UNDP-AHDR, 2002; 2003; 2005; 2009). Particularly, the impediment factors related to higher education and training are linked to low quality of the educational system, low tertiary education enrolment rate (gross tertiary enrolment rate), weak local availability of specialized research and training services and poor extent of staff training in most MENA countries (Figures 67-70). The literature identifies issues pertaining to human capital and education deficiencies among the factors that threaten to affect sustainable growth and development in the Arab region. "Exceptional economic growth in the Arab region over the past decade has not coincided with

equally buoyant labour and human resource development, raising obvious concerns for sustainable and balanced growth. The CEOs survey (2007-2008) results reveal that only 38% of Arab CEOs believe that there is an ample supply of qualified national labour, which therefore translates to a heavy reliance on the recruitment of expatriates. [The Arab region suffers from] the problems of low education capability index." (Mohammed bin Rashid Al Maktoum Foundation (MBRF)-Arab Human Capital Challenge Report, 2010).[67] "The MENA countries mostly fall below the middle range on the Knowledge Economy Index. They also fall below the scores obtained by OECD countries, most of the transition economies, and some East Asian countries."(The World Bank, 2008)[68, 69] "The low employment rate in the MENA region has put pressure on the demand for knowledge – low economic returns lead to low demand for education- and supply of knowledge – the ability of the government and increasingly, private sector actors to provide good quality of education. Education and training systems have achieved significant quantitative progress, but suffer from weaknesses in terms of quality. The region has invested a lot compared to its GDP but the lack of incentives to performance and lack of accountability are the main reasons behind this poor situation." (Zeidane, 2011)[70] "Although the MENA countries spend more on education than other countries at comparable income levels, their educational systems do not perform better [the quality of human capital has not advanced correspondingly]. Possible reasons for this include emphasis on quantity at the expense of quality of teachers, lagging educational technology, inflated administrative bureaucracies, and a spending bias toward higher, rather than primary education." (Abed and Davoodi, 2003)[71,72] "The MENA region education systems did not produce what the markets needed, and the markets were not sufficiently developed to absorb the educated labour force into the most efficient uses." (The World Bank, 2008)[73]

Knowledge transfer through utilization of education and human capital in the MENA region is hampered not only by the poor quality of education, but also extremely impeded by the incidence of skill gap and mismatch between attained and required education. For instance, the literature indicates the skills gap problem and realises that "the lack of available talent and trained resources was the greatest threat identified by Arab CEOs for sustainable development. Only half of the

[67] See Mohammed bin Rashid Al Maktoum Foundation- Arab Human Capital Challenge Report (MBRF-AHCCR), (2010) "Arab human capital challenge: The Voice of CEOs," Report prepared in cooperation with PricewaterhouseCoopers and the Intelligence and Strategy Unit, Dubai, UAE, see http://mbrfoundation.ae/English/Documents/AHCC-%20English.pdf pp. 2, 4.

[68] See the World Bank (2008)"New Challenges Facing the Education Sector in MENA," pp, 84-86, 110-111.

[69] To measure the extent to which economies possess this kind of knowledge, the World Bank has developed a Knowledge Economy Index (KEI) using four indicators. The indicators attempt to capture whether: (i) an economic and institutional framework that provides incentives for the efficient creation, dissemination, and use of knowledge to promote growth and increase welfare is in place; (ii) an educated and skilled population that can create and use knowledge has been established; (iii) an innovation network composed of firms, research centers, universities, consultants, and other organizations that can tap into the growing stock of global knowledge, adapt it to local needs, and transform it into products valued by markets (good and market effects) has developed; and (iv) a dynamic information infrastructure that can facilitate the effective communication, dissemination, and processing of information has been put in place.

[70] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region" the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp. 3.-4

[71] See George T. Abed and Hamid R. Davoodi (2003)"Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund, pp. 18-20.

[72] Most education systems in MENA countries are managed by at least three ministries.

[73] See the World Bank (2008) "MENA Development Report: The Road Not Traveled Education Reform in the Middle East and North Africa," pp. 2-3.

CEOs surveyed believe that there are sufficient numbers of qualified students coming out of the education system, with 54% citing that new graduates carry the right skills set. Equally, only 48% believe that these skilled students are provided in sufficient quantities." (MBRF-AHCCR, 2010)[74] The literature shows the problem of skills gap and its impact in firm performance in the Arab region and finds that "in the Arab World there is a poor match between regional human capital and the skills demanded by employers with many firms expressing concern that they face internal employee skills deficiencies that limit performance." Schwalje (2011a) The literature examines "the effectiveness of Arab investment in human capital and shows marginal progress towards knowledge-based development over the last decade. A disconnect between the skills developed in Arab skills formation systems and those required by private sector employers relegates Arab businesses to contesting lower-skilled, non-knowledge intensive industries which has stalled knowledge-based development in the region. "Schwalje (2011b) Skills gaps measures estimated by Schwalje (2011a; b) consist of global skills gaps measure that implies that in the Arab region for nearly quarter the attained skills do not match the required skills (24%) and regional skills gaps measure that implies that for nearly half the attained skills do not match the required skills (44%) based on the World Bank Enterprise Survey data and MBRF/PWC Arab Human Capital Challenge report respectively (Table 5, Figure 71).[75,76] These results are consistent with the results in the literature which imply that "in some countries, the system produces graduates with skills that are not in demand in a modern, globalizing economy." (Abed and Davoodi, 2003)[77] "the MENA region education systems did not produce what the markets needed, and the markets were not sufficiently developed to absorb the educated labour force into the most efficient uses" (the World Bank, 2008)[78]

[74] See Mohammed bin Rashid Al Maktoum Foundation (2010) "Arab human capital challenge: The Voice of CEOs," Report prepared in cooperation with PricewaterhouseCoopers and the Intelligence and Strategy Unit, Dubai, UAE, see http://mbrfoundation.ae/English/Documents/AHCC-%20English.pdf pp. 2, 4.

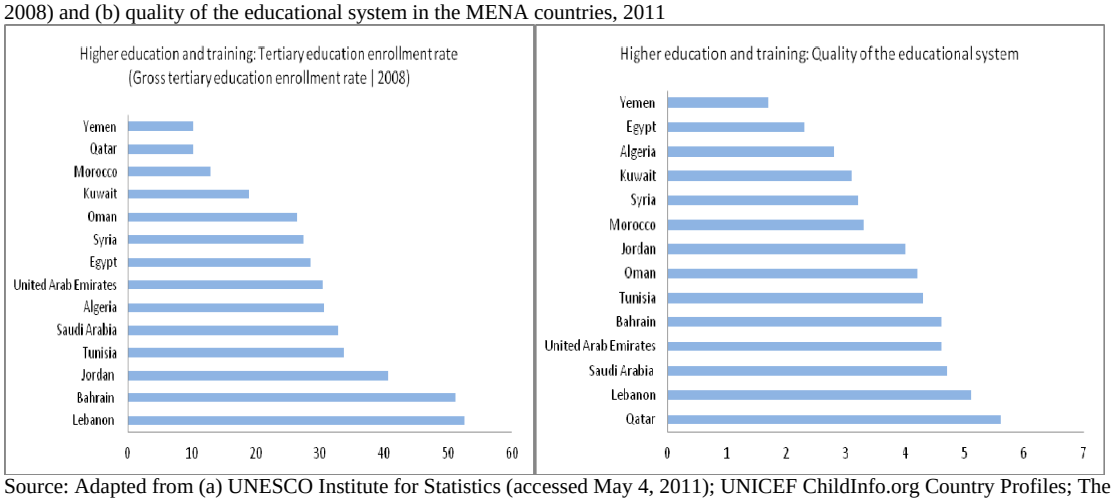
[75] See Wes Schwalje (2011a) "Examining Global Skills Gaps: How Skills Gaps Impact Firm Performance in the Arab World," International Human Resources Conference and Exhibition Dubai, United Arab Emirates, January 19-20, 2011, pp. 2, 6-7. See also Wes Schwalje (2011b) "Knowledge-based Economic Development as a Unifying Vision in a Post-awakening Arab World," London School of Economics (LSE) Working Paper, Version 2.0, September 2011, p. 2. According to Schwalje (2011a, b), the World Bank Enterprise Survey is used to proxy global prevalence, it is based on a survey of 100,000 private companies in 143 countries from 2002-2010. The survey asked "Is an inadequately educated workforce represent, no obstacle, a minor obstacle, a moderate obstacle, a major obstacle, or a very severe obstacle to the current operations of the establishment?". Skills gaps are proxied as a ratio of the number of firms who answered major obstacle or very severe obstacle to this question to the total number of firms surveyed. MBRF/PWC Arab Human Capital Challenge report is used to proxy regional prevalence. It is based on a survey of 587 CEOs in12 industry sectors in18 Arab countries in late 2007. The survey asked "Does the education system provide people with adequate skills and in sufficient quantities to the economy?" Skills gaps are proxied by the percentage of respondents who answered that the education system does not provide people with adequate skills.

[76] Other studies in the Gulf literature indicate significant skill mismatch at the macro-micro level in the Gulf countries, see Samia (2005), "Technological Change and Skill Development in the Arab Gulf Countries," Doctoral Dissertation, Maastricht University Press, Maastricht, the Netherlands, November 2005. See also Joan Muysken and Samia Nour (2006),"Deficiencies in Education and Poor Prospects for Economic Growth in the Gulf Countries: The Case of the UAE," *The Journal of Development Studies*: Routledge: Taylor and Francis Group Ltd., UK, Vol. 42, No. 6, August 2006, pp. 957-980.

[77] See George T. Abed and Hamid R. Davoodi (2003)"Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund, pp. 18-20.

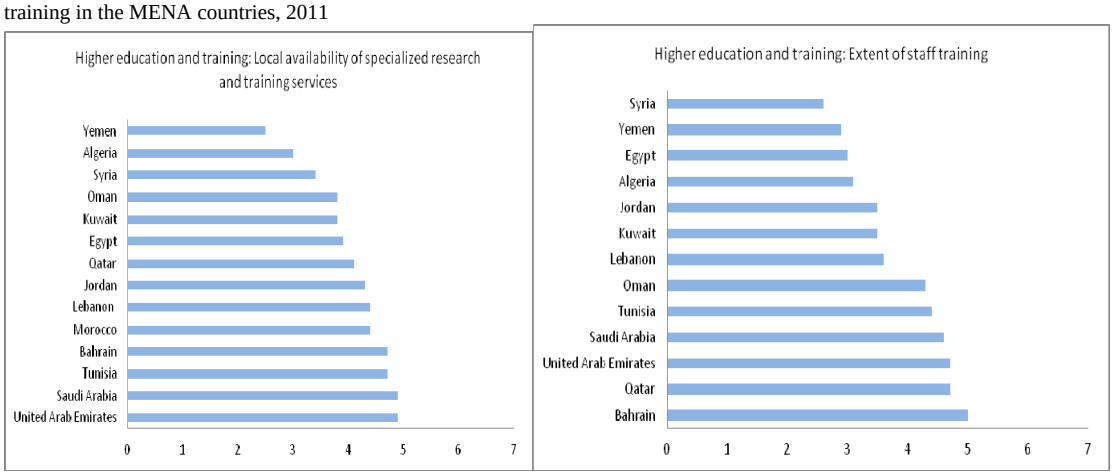
[78] See the World Bank (2008) "MENA Development Report: The Road Not Traveled Education Reform in the Middle East and North Africa," pp. 2-3.

Figures 67-68- Higher education and training: (a) Tertiary education enrolment rate (Gross tertiary education enrolment rate 2008) and (b) quality of the educational system in the MENA countries, 2011



Source: Adapted from (a) UNESCO Institute for Statistics (accessed May 4, 2011); UNICEF ChildInfo.org Country Profiles; The World Bank, EdStats Database(accessed July 8, 2011); national sources and The World Development Indicators 2009 (CD-Rom edition), cited in GCR (2011), p 443, (b) WEF-EOS, cited in GCR (2011), p. 444.

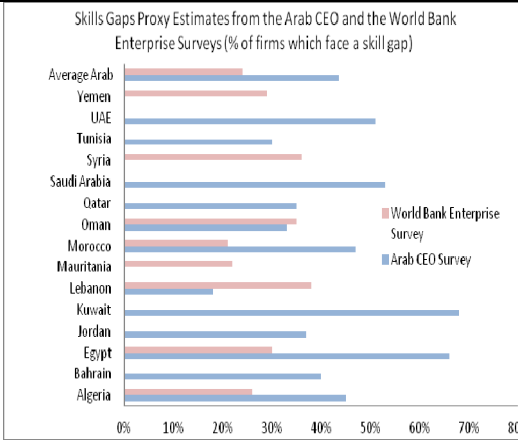
Figures 69-70 - Higher education and training: local availability of specialized research and training services and extent of staff training in the MENA countries, 2011



Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 448-449.

Table- 5- Figure -71 - Skills Gaps Proxy Estimates for Arab countries (% of firms which face a skill gap), 2008-2010

Country	Arab CEO Survey [a]	World Bank Enterprise Survey [b]
Algeria	45%	26% (2002)
Bahrain	40%	NA
Egypt	66%	30% (2004)
Jordan	37%	NA
Kuwait	68%	NA
Lebanon	18%	38% (2006)
Mauritania	NA	22% (2006)
Morocco	47%	21% (2004)
Oman	33%	35% (2003)
Qatar	35%	NA
Saudi Arabia	53%	NA
Syria	NA	36% (2003)
Tunisia	30%	NA
UAE	51%	NA
Yemen	NA	29% (2010)
Average Arab	44%	23.98%



Sources: Adapted from (a) MBRA Foundation (2008); and (b) the World Bank (2010), cited in Schwalje (2011a, b)

Knowledge transfer through utilization of human capital mobility in the MENA region is greatly hampered by the incidence of brain drain. For instance, the Arab countries are well known for the brain drain defined by the number of scholars leaving abroad (or students never coming back after

obtaining their degree). Numerous students who left to improve their positions abroad do not come back home. And many academics or researchers emigrated since the 1990s.[79] The brain drain problem can be interpreted due to push factors from the countries of origin and pull factors from the host countries. In the MENA countries, one of the "push" factors behind the outflow of students and migrants is the relative weakness of the local labour market. Economic growth in most MENA countries has not been enough to absorb the increasing labour force.[80] The total number of Arab students enrolled in foreign universities outside the MENA region was about 120,000 in 1999, a number higher than Chinese students (106,000) or Indian students (53,000) studying abroad.[81] The literature shows brain drain problem and "estimates that 12,000 Arabs are awarded Ph.Ds. abroad annually and that 85 per cent, or more, of these brain drain. This is a loss to the Arab World of around 10,000 Ph.D. graduates annually. Consequently, there are 60,000-70,000 Arabs having Ph.Ds. working in the Arab World compared with an estimated 150,000 abroad. Arab countries have invested more in education, at home and abroad, than either China or India. Obviously, it is not the amount of human capital that is making China and India the champions of development and the Arab countries slow developers ….. it is rather the national science and economic policies adopted by Arab States that deprives them of the benefits of their substantial human capital. The total number of Arabs who brain-drained to OECD Member Countries by 1999 was 967,548, which is roughly 300,000 *more* than Indians, and only slightly lower than Chinese, on a per capita basis, the Arab brain drain is four times greater than that of China; and five times that of India. Overall emigration from China and India is 3.6 million compared to 4.5 million from the Arab World. Thus, China and the Arab World export an equal number of highly skilled personnel. But in terms of total emigration (skilled and semi-skilled, and dependents) the Arab World exceeds China and India combined. An important reason why the Arab brain drain is much higher on a per capita basis than that of China or India is that the Arab countries allocate the lowest proportion of their GNP to R&D, the Chinese and Indian governments devote far more towards R&D than any Arab government, China spends ten times more than the Arab countries on R&D per inhabitant and India spends three times more." (Zahlan, 2007)[82]

Another reason for the incidence of brain drain is that although the Arab countries have by now an important S&T potential, but it is little tapped for research, consequently brain drain takes a heavy toll. Another reason for the brain drain is the poor treatment and remuneration of profession, for

[79] See Mouton, Johann, and Roland Waast. 2009. Comparative study on national research systems: Findings and lessons learnt. In Higher education, research and innovations: Changing dynamics, Report on the UNESCO Forum on Higher Education, Research and Knowledge 2001–2009, eds. V. Lynn Meek, U. Teichler, and M.L. Kearney, 147–169. Kassel: Kassel University (Incher-Kassel). pp.163-164.

[80] See the World Bank (2011) "Internationalization of Higher Education in MENA: Policy Issues Associated with Skills Formation and Mobility," Report No: 63762-MNA, pp. 3, 5-6, 12.

[81] See Georges Corm (2006) World Bank "Labor Migration in the Middle East and North Africa A View from the Region," pp. 25-26

[82] See A. B. Zahlan (2007) "Higher Education, R&D, and Economic Development: Regional and Global Interfaces". In: "The Impact of Globalisation on Higher Education and Research in the Arab States", Regional Research Seminar, Rabat, Morocco, pp. 147-163. A.B. Zahlan, (1999) "*Science and Technology in the Arab World: Progress without Change*, " The Centre for Arab Unity Studies (CAUS), Beirut. (in Arabic)., pp. 4-7. See also Georges Corm and the World Bank (2006) "Labor Migration in the Middle East and North Africa, A View from the Region", pp. 25-26.

instance, exodus is important in Egypt and the Maghreb countries, particularly, Egypt and Algeria are the main countries hit by exodus and where the brain drain has become a massive and structural problem. Because, "the profession is rather poorly treated and the remunerations were dreadfully eroded by price rise; an important emigration takes place continuously; and professionals are often busy with parallel tasks (contracts for teaching or doing research elsewhere) to make their living.[83] A few years ago, there were as many Egyptian scientists employed in R&D through the world as there were (FTE) in their own country; and twice to four times more regarding Mashreq countries. By 2000 official statistics from NSF (USA) counted 13,000 Egyptian scientists and engineers established in USA, out of whom 5,000 were employed in the R&D sector. This could amount to 35,000 Egyptian highly skilled in S&T established in developing countries. For the Near East, the NSF figures were also spectacular (Table 6).[84] According to the NSF, very few scientists from Maghreb were established in USA. But Scientists from Maghreb are heading for Europe (mainly France) and recently for Canada. A bibliometric study in the social sciences has just proved that 60 per cent of the 100 most productive social scientists from Algeria were now living and employed abroad (50 per cent of the 200 most productive, authoring more than 1/3 of the production in the last 25 years). The proportion of Moroccan authors living abroad is 15 per cent of the 100 most productive (Rossi and Waast, 2008). According to the Algerian trade unions the number of Algerian scientists established abroad had increased from 2,400 in 1984 to 27,500 in 1994; and 90% of scholarship holders never came back from abroad in 1995. To this should be added the well-known exodus of "highly qualified persons" (among whom a number of leading researchers and academics) during the civil war of the 1990s." (Khelfaoui, 2004).[85] Though the situation is less dramatic in Morocco and Tunisia, brain drain is also noteworthy. … The brain drain trend shows that there is a large S&T potential in Arab countries, and a lot of frustrations among them … there is a need for more incentives [e.g. financial rewards and personal incentives]. [86]

Table 6- Number of scientists and engineers established in USA (born in the Near East), 2000

	Egypt	**Lebanon**	**Jordan**	**Syria**	**Palestine**	**Kuwait**	**Maghreb**
Established in USA	12,500	11,500	4,000	5,000	2,600	2,400	
Employed in R&D	4,400	4,900	2,000	1,800	700	1,200	
Researchers in the country headcount*	75,000	6,000	6,500	Nd	2,400	40,000	
Researchers in the country FTE*	15,000**	600	750	400**	Nd	500	8,000

Source: NSF, cited in Johnson, J. (NSF), in Barré, R. and Meyer, J.-B. 2003. *Scientific Diasporas*. Paris: IRD.
* = ESTIME; ** STS

The literature discusses brain drain in MENA countries and indicates that "Egypt has the highest proportion of skilled workers in total emigration stock or the stock of emigrants from MENA in OECD countries. Among the 195 countries studied by Docquier and Marfouk (2004), Egypt and Jordan are among the top 30 countries with the highest proportion of skilled emigrants in the total emigration stock. Egypt is ranked 19 and Jordan 27, with a 59 percent of high skilled workers in

[83] See ESTIME Report (2007), pp. 36-37, 51-55.
[84] The Near East is defined to include Lebanon, Jordan, Syria, Palestine, Kuwait for the main origins.
[85] See Mouton, Johann, and Roland Waast. 2009. Comparative study on national research systems: Findings and lessons learnt. In Higher education, research and innovations: Changing dynamics, Report on the UNESCO Forum on Higher Education, Research and Knowledge 2001–2009, eds. V. Lynn Meek, U. Teichler, and M.L. Kearney, 147–169. Kassel: Kassel University (Incher-Kassel). pp.163-164.
[86] See ESTIME Report (2007), pp. 36-37, 51-55.

Egypt and 56 percent in Jordan. While, Tunisia and Morocco are among the 30 lowest countries in terms of the proportion of high skilled workers, i.e., only 13 percent of Moroccan and 15 percent of Tunisian emigrants are high skilled. Lebanon has the highest emigration rate[87] of skilled workers in MENA and ranks 27 out of the 195 countries studied in 2000. Morocco and Tunisia both have high emigration rates of skilled workers, i.e. comparing the emigration stocks of the highly educated to the total number of highly educated people born in the source country. Although both countries have a low proportion of skilled emigrants in their total emigration stock, the proportion of highly educated emigrants to the total number of educated people back home is high, i.e. they are more vulnerable to brain drain. Overall MENA countries are not experiencing worrying levels of brain drain as a region. However, Lebanon in particular, followed by Morocco and Tunisia, are losing a substantial proportion of their educated population. (Docquier and Marfouk, 2004). (Table 7, Figure 72)" (The World Bank, 2008) These results are consistent with the results in the literature which find that "out of a sample of 24 countries, international migration takes more than 10 percent of those with a tertiary education from five countries: Jamaica, Morocco, Tunisia, Turkey, and Sri Lanka" (Adams 2003). Thus, "the evidence suggests that there is a brain drain in Morocco and Tunisia, which would suggest that there is a need for these countries to adopt policies to deal with this loss of human capital." (The World Bank, 2008)[88] "Tunisia and Lebanon have 20 percent of tertiary enrolments abroad, which increases potential skill loss". (The World Bank, 2011)[89]

These results are also consistent with the results in the literature which examine "the exodus of skilled labour in Morocco and Algeria and find that a large number of Morocco best IT specialists have indeed left for the US, Canada, Germany and France." (Mghari, 2004).[90, 91] "At the National

[87] Emigration rates by educational levels are obtained by comparing the emigration stocks to the total number of people born in the source country and belonging to the same educational category.

[88] See the World Bank (2008) "New Challenges Facing the Education Sector in MENA," pp, 84-86, 110-111, 266-271, 275-276. According to the report the "brain drain," which occurs when a labor-exporting developing country loses its educated workers to a more developed or richer country, has been hotly debated in the development literature for some time. Because migration is generally easier for university graduates than for the less educated, the argument, as Adiseshiah (1972) puts it, is that for many countries, "education is not the road to development but the road to migration." However, others, like Mountford (1997) and Stark et al. (1998), argue that the emigration of the highly educated may lead to "brain gain" if the return to education is higher overseas than at home, thus leading to higher returns to human capital, and thereby enhancing further investment in human capital. At any rate, from the point of view of the sending country, the extent of migration selectivity, the opportunity cost of losing an educated worker, and the temporary or permanent nature of the migration all make a difference to the impact of the migration on the home country. The World Bank 2008 discusses the brain drain and indicates that for the MENA region, intraregional migration is different from migration to Europe and elsewhere. For some MENA countries, intraregional migration is temporary, and as such does not lead to the permanent loss of educated people, in light of the high unemployment in the [MENA] exporting countries, the opportunity cost of keeping university graduates at home is low if not zero or even negative. Thus, the brain drain problem is not so in intraregional migration in MENA. With respect to emigration from MENA to OECD countries, the picture is somewhat different. Migration to OECD tends to be permanent. Recent OECD data on the emigration rate to OECD countries from MENA suggests that Lebanon and the Maghreb countries have higher emigration rates than the rest of the MENA countries. The expatriate rate is around 10 percent in Lebanon and between 6 and 8 percent for the Maghreb countries. The emigration rate from other MENA countries to OECD is under 2 percent.

[89] See the World Bank (2011) "Internationalization of Higher Education in MENA: Policy Issues Associated with Skills Formation and Mobility," Report No: 63762-MNA, p. 17.

[90] Mghari (2004) indicates that in the IT field alone, in 1999, a single foreign enterprise announced the recruitment of more than 600 information engineers, among which the best of the Moroccan IT specialists. Naturally they are attracted by the proposed salaries, which sometimes can be as high as four times the salary of a Moroccan engineer at home. See Mohamed Mghari (2004) "Exodus of skilled labour: magnitude, determinants and impacts on development," in International Organization for Migration, (2004) "Arab Migration in a Globalized World," May, 2004, Switzerland, Geneva, pp. 71-89.

[91] Without the development of endogenous scientific and technical communities, human movement would not be possible, and without the circulation of scientific information outside private networks (even if global), there would be no movement of knowledge through international (or even cross-border) scientific networks. Under this hypothesis, the brain drain could grow owing to the fact that if privatization of science contributes to its confidentiality, it simultaneously intensifies human mobility,

Centre for Scientific Research in France there are over 700 Moroccan researchers, ranking immediately after the US, Germany and the UK. With 500 Algeria ranks after Spain, Italy and Canada and with 450 Tunisia is placed just after Poland and Brazil. Thus, the Maghreb countries have more than 1,600 researchers attached to only one institution, without counting those active in universities and other specialized institutions. …. In Algeria, the accelerated irreversible emigration of scientists is due to the failure of management approaches experienced by the country at all levels: the state, university and the private sector... the intensified migration by the highly skilled has led to emptying [Algeria] local institutions of their trained manpower and led to the widespread use of the term "haemorrhage" to designate this loss. Over recent years, over two-thirds of the instructors at the Mathematics Institute of the University of Algiers returned to the countries where they were educated. In Morocco, a study conducted by the cultural association of engineering students of the French institutes for applied sciences in Morocco in 1999, interpret the brain drain due to five essential factors. For instance, 88.7 per cent of the respondents Moroccan do not think of the intention of returning to Morocco at all for the following reasons: the first fundamental factor represents a major handicap is mentalities reason, for nearly two-thirds, the archaic character of mentalities, especially culturally, would keep them from returning to their country. Secondly, the lack of transparency of the social and economic rules, for just under one-third of the respondents in Morocco, the marginalization of competences, the passion for abroad, the promotion through family contacts and networks would represent obstacles to their return. Third, the inadequacy of careers and of available opportunities, for 13.3 per cent of the respondents, the lack of viable and attractive work and research opportunities have discouraged or frustrated their return. Real career opportunities are almost non-existent in the administration as much as in the private sector, especially industrial. Fourth, the low salaries, for just over 10 per cent of the respondents, material considerations played a role in their decision to return. Fifth, the other less important reasons include security, freedom, and working conditions. Therefore, the brain drain cannot be fundamentally explained by market factors. The question of salary appears of secondary importance compared with other factors. The main factor of the phenomenon is found in the general environment, which is not favourable enough, if not actually hostile, to this kind of competence. This [lack of favourable environment] concerns among others, a lack of transparency in the administration of careers, a lack of freedom and very difficult working conditions, the scarcity of interesting and valuable opportunities offered, especially as concerns

for the simple reason that scientific professions depend increasingly on specific project funds and are more and more involved in the framework of temporary contracts. How can we then expect to stop that these tendencies will contribute to endorse elite migratory flows towards countries where the world's private sciences will be concentrated?" (Gaillard and Gaillard, 1999). (p. 72). The growing demand for qualified and mobile labour plays an important part in generating the brain loss observed in developing countries. Exodus of skilled labour means the migration of qualified and intellectual persons from developing countries to industrialized countries, on one hand, and from Europe to North American on the other. The linguistic formulations in the attempt to apprehend this phenomenon are various: drain, exodus, mobility, circulation, transfer. (p. 73). In fact, that mobility of competencies has become synonymous with loss for countries of origin and gains for countries of reception (p.74). Nevertheless, the exodus of skilled labour is a phenomenon that should not only be analysed from the point of view of the host countries, but also from the country of origin. The major three explanatory reasons that stress scientific migration at several levels includes economic reasons (scientists are in search for better conditions of work, remuneration, standard of living and carrier opportunities); political reasons (more security, higher freedom of expression and recognition); and scientific reasons (lack of scientific and research infrastructure. Even if the same motives are always present, their importance changes in Morocco.

the industrial and technological areas. Under such conditions, the ambition for prosperity, to feel useful and to have a continuity of prospects and improvement can only be satisfied abroad. The phenomenon of the exodus of skilled labour takes on even more alarming proportions, particularly in Morocco, since it touches sectors and activities of high technology and with strong value-added potential and it concerns especially graduates of some important high performance engineering schools." (Mghari, 2004)[92]

While, on the one hand, the migration of Arab students and brain drain hindered knowledge transfer in the MENA countries, but on the other hand, the internationally mobile students hosted by the Arab countries has the potential to support brain gain and knowledge transfer in the Arab countries (Tables 8-9, Figures 73-76).[93] Apart from the negative impact of brain drain, the international mobility of human capital and scientific cooperation with international universities are important for the transfer of knowledge in the MENA region. Particularly because "one of the most distinctive features of higher education in the MENA region is the large presence of foreign providers, for instance, the Middle East hosted 34 percent of all international branch campuses worldwide in 2009, according to the Observatory on Borderless Higher Education (OBHE, 2011). MENA is also a host region for international students: Egypt, Jordan and Lebanon are among the thirty top host countries in the world." (The World Bank, 2011) [94] In 2009, overall, Arab countries host few worldwide students (5.6%), and very few students from OECD nations: North America and Western Europe (1.0%), moreover, 6.9 percent of worldwide higher education students who study abroad were from MENA countries.[95] Most MENA international students movement is to North America and Western Europe (64.5%), followed by intra-regional, i.e., between MENA countries (19.5%) (Table 8). The UK, US, France, Germany, and Australia receive around 74% of all international Arab students, 54% of international Gulf Arab students, 82% of international Mediterranean Arab students, and 50% of the other non-Gulf-non-Mediterranean Arab students. This implies that, with regard to the distribution of internationally mobile students from the Arab countries, the majority of Arab students in the UK, US, France, Germany, and Australia are from

[92] This includes, among others, the Mohamedia School of Engineering (EMI), the National Institute of Post and Telecommunication (INPT). Thus, generally 50 to 70 per cent of all those graduating from this kind of schools travel abroad each year either immediately following the conclusion of their education, or after a few years of experience. (p. 81). The brain drain empties Moroccan enterprises of their most competent manpower and of their brains; thus, it represents a big handicap in the search for improved competitiveness and productivity (pp. 82-83). In such conditions, [Morocco and] developing countries find themselves caught in a vicious circle. On the one hand, they train staff and engineers at soaring costs, who then go abroad and, on the other, they have to call on foreign experts at extraordinary costs to fill their needs. See Mohamed Mghari (2004) "Exodus of skilled labour: magnitude, determinants and impacts on development," in International Organization for Migration, (2004) "Arab Migration in a Globalized World," May, 2004, Switzerland, Geneva, pp. 71-89. (pp.77-83).

[93] See UNESCO-UIS-Global Education Digest 2011 and the UNDP-Human Development Report 2009 "Overcoming barriers: Human mobility and development".

[94] University partnerships (exclusively based on the principle of non-profit collaboration) are the traditional and probably most common form of international mobility of higher education. This type of partnership often goes hand in hand with the mobility of students and academics. However, cross-border education of a commercial nature plays an essential part in the Asia Pacific and is developing now in the MENA region, where it mostly takes the form of franchising. There are forty branch campuses in MENA. See the World Bank (2011) "Internationalization of Higher Education in MENA: Policy Issues Associated with Skills Formation and Mobility," Report No: 63762-MNA, pp. 3, 5-6, 12.

[95] In 2009 out of 3,369,242 worldwide higher education students study abroad about 232463 students were from Arab countries.

Mediterranean (68%), Gulf (20%), and other non-Gulf-non-Mediterranean Arab (12%) countries (Table 9). [96]

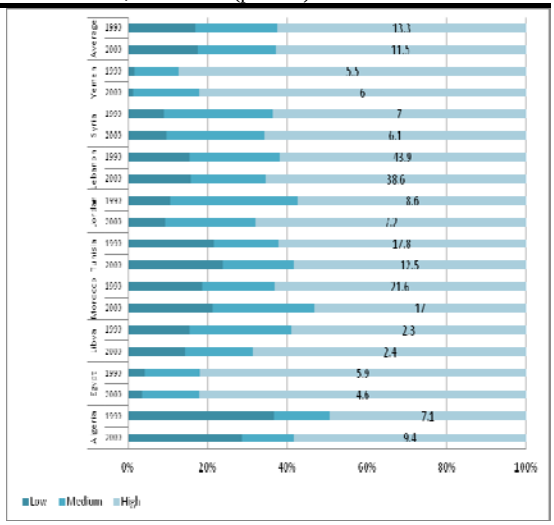
The transfer of knowledge is also hindered by the limited international and intra-regional scientific cooperation. Cooperation in scientific research and international mobility of students indicates that the growing influence of private and foreign universities across the Arab regions exerts its effects too on scientific research, particularly in Gulf Arab countries where the share of foreign universities in science and engineering faculties and institutes stands at approximately one-third of the total number of such faculties and institutes. Moreover, international organizations enrol 18% of all foreign students and 45% of all foreign staff in Gulf universities over the period 1995–2001 and 1995–2002, respectively. The prevalence of private foreign universities in the Gulf Arab countries parallels their heavy reliance on imported labour while their Mediterranean counterparts rely to a greater extent on the export of labour. The influence of international (foreign) institutions on higher education in the Arab countries is also reflected in the data on the international mobility of Arab students. The above results on weak intra-regional mobility within the larger Arab region are consistent with the findings of Zahlan, who found weak cooperation in scientific research and scientific publications among Arab countries. In his pioneering empirical study, Zahlan (1999a, b) found very limited cooperation in scientific policy and research endeavours in both the Arab Gulf and Mediterranean countries, as measured by the number of joint or co-authored publications among scientists. On the other hand, the cooperation between Maghreb countries and other Arab scientists accounts only for 3% and 3.5% of total joint published papers in 1990 and 1995 respectively'. Moreover, ESTIME (2006) provides more up-to-date analysis of the increasing international collaboration and the degree of internationalization of S&T activities that can be measured by SCI co-publications or co-authors in scientific publications in the Mediterranean region (2004). According to ESTIME (2006), however, cooperation through co-publications, most importantly co-authorships patterns are very different from one country to the other, Egypt (with 32% of co-publications), and Jordan (37%) have, in relative terms, less co-publications with a foreign country; Lebanon (48%) and Tunisia (49%)- which both have many co-publications with France-are less ''open'' in relative terms than Morocco (60%) and Algeria (65%). Until recently, the Gulf Arab countries also have limited cooperation with foreign institutions. In contrast, their Mediterranean Arab counterparts have significant ones. In particular, the Maghreb countries cooperate significantly with the OECD countries. For instance, the joint papers of the Maghreb-OECD countries account for 90% and 81% of total joint publications in the Maghreb countries in 1990 and 1995, respectively. Among the OECD countries, France has the highest level of cooperation and share of co-authored papers with Algeria, Morocco, and Tunisia. Maghreb-France cooperation accounts for 67% and 62% of total joint papers in 1990 and 1995, respectively…. Zahlan argues that scientific workers in the Maghreb, on an individual level, have become deeply integrated into the international scientific community. They do not appear, however, to have

[96] See Samia (2011a) "National, Regional and Global Perspectives of Higher Education and Science Policies in the Arab Region" *Minerva: A Review of Science, Learning and Policy*, Minerva, Springer, Germany, Vol. 49, No. 4, December 2011, pp. 387-423.

become integrated into their national or regional economies or societies. It is clear from the data that the level of cooperation within the two regions remains extremely limited.[97]

Table 7- Figure 72- Emigration Rates from MENA to OECD by Educational Level, 1999-2000 (percent)[98]

Educational level	Year	Low	Medium	High	Total
Algeria	1990	5.3	2	7.1	5.1
	2000	4.6	2.1	9.4	4.5
Egypt	1990	0.3	1	5.9	0.8
	2000	0.2	0.8	4.6	0.9
Libya	1990	0.6	1	2.3	0.9
	2000	0.5	0.6	2.4	0.9
Morocco	1990	6.4	6.2	21.6	7
	2000	6.8	8.1	17	7.6
Tunisia	1990	6.2	4.6	17.8	6.5
	2000	5.1	3.8	12.5	5.4
Jordan	1990	1.6	4.8	8.6	3.5
	2000	1	2.4	7.2	2.8
Lebanon	1990	10.9	16.1	43.9	17.2
	2000	9.4	11.1	38.6	15
Syria	1990	1	3	7	1.9
	2000	0.9	2.3	6.1	1.9
Yemen	1990	0.1	0.7	5.5	0.2
	2000	0.1	1.2	6	1.4
Average	1990	3.6	4.4	13.3	4.8
	2000	3.2	3.6	11.5	4.5



Source: Docquier and Marfouk (2004), cited in the World Bank (2008), p. 270.

Table- 8- International flows of tertiary mobile students in Egypt, Jordan, Morocco, Arab and World regions, 2009[99]

Country	Students from a given country studying abroad (outbound mobile students)		Number of students from abroad studying in a given country (inbound mobile students)	Net flow of mobile	Students (inbound - outbound)	Top five destinations (host countries) for outbound mobile students (the number of students from a given country studying in the host countries is shown in brackets)
	MF	Outbound mobility ratio (%)		MF	Net flow ratio (%)	
Egypt [(1)]	10,257	0.41	35,031	26,579	1.1	U.S.A. (1,884), U.K. (1,439), France (1,190), Germany (1,139), Canada (711)
Egypt (%) [(2)]						U.S.A. (18.37%), U.K. (14.03%), France (11.60%), Germany (11.10%), Canada (6.93%)
Jordan [(1)]	10,102	4.0	26,637	16,541	6.5	Ukraine (2,203), U.S.A. (2,188), U.K. (1,329), Saudi Arabia (558), Germany (541)
Jordan (%) [(2)]						Ukraine (21.81%), U.S.A. (21.66%), U.K. (13.16%), Saudi Arabia (5.52%), Germany (5.36%)
Morocco[(1)]	42,009	10.0	7,921	-34,088	-8.1	France (27,051), Germany (3,748), Spain (3,165), Canada (1,587), Italy (1,207)
Morocco (%) [(2)]						France (64.39%), Germany (8.92%), Spain (7.53%), Canada (3.78%), Italy (2.87%)
Arab States[(1)]	232,463	3.0	187,008	-45,455	-0.6	North America and Western Europe (64.5%), Arab States (19.5%), East Asia and the Pacific (7.2%), Central and Eastern Europe (6.7%), South and West Asia (1.8%), Central Asia (0.5%), Latin America and the Caribbean (0.2%), Sub-Saharan Africa (0.1%)
World[(1)]	3,369,242	2.0	3,369,242			North America and Western Europe (58.6%), East Asia and the Pacific (20.2%), Central and Eastern Europe (9.2%), Arab States (5.6%), Latin America and the Caribbean (2.4%), Sub-Saharan Africa (2.3%), Central Asia (1.4%), South and West Asia (0.5%)

Sources: (1) UNESCO-UIS-Global Education Digest 2011: Table 12 Tertiary Education / ISCED 5 and 6 / International flows of mobile students/ 2009, pp. 200, 205, (2) Own calculation based on data from (1). UNESCO-UIS-Global Education Digest 2011:

Table 9- Intra-regional and International Mobility of Students from Egypt, Jordan, Morocco and Arab Countries, 1999-2004

Total countries)	(allIntra Regional Mobility (within the Arab region)					International (or internationally mobile) students. Total: Students from a given country studying abroad)				
	Gulf/ total (%)	Med/ total (%)	Other/ total (%)	All Arab/ total (%)	USA/ Total (%)	UK/ Total (%)	France/ Total (%)	Germany/ Total (%)	Australia/ Total (%)	Studying in USA, UK, France, Germany and Australia / Total Students from a given country studying abroad
Egypt	0.029	0.002	0.013	0.045	0.25	0.128	0.109	0.18	0.011	0.678
Morocco	0.001	0.001	0.008	0.01	0.04	0.004	0.723	0.181	0	0.948
Jordan	0.049	0.004	…	0.053	0.245	0.125	0.028	0.152	0.022	0.572
Arab Countries	0.027	0.009	0.033	0.07	0.119	0.068	0.42	0.116	0.01	0.733

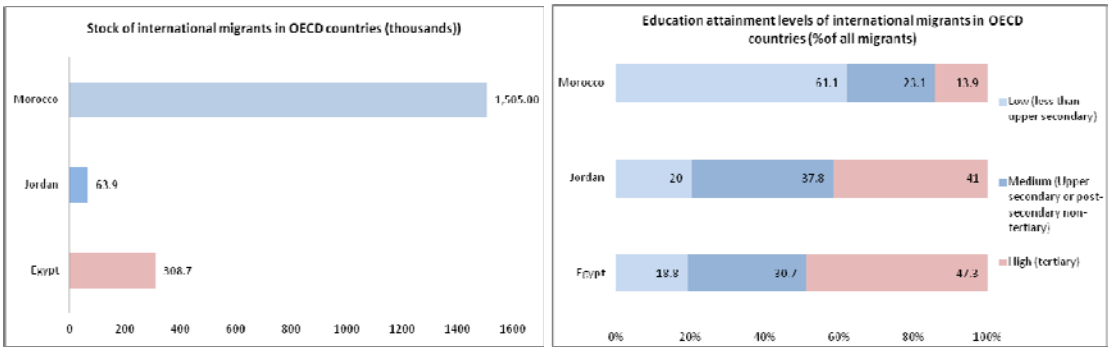
Source: Own calculation based on data from the UIS-UNESCO Global Education Digest (2006) statistics on International (internationally mobile) students: UIS- UNESCO web site

[97] See Samia (2011a) "National, Regional and Global Perspectives of Higher Education and Science Policies in the Arab Region" *Minerva: A Review of Science, Learning and Policy*, Minerva, Springer, Germany, Vol. 49, No. 4, December 2011, pp. 387-423.

[98] Note: Emigration rate is the emigration stock as a share of the total number of people born in the source country and belonging to the same educational category. Low education: primary education (or 0 to 8 years of schooling);medium education: secondary education (9 to 12 years of schooling); high education: tertiary education (13 years and above).

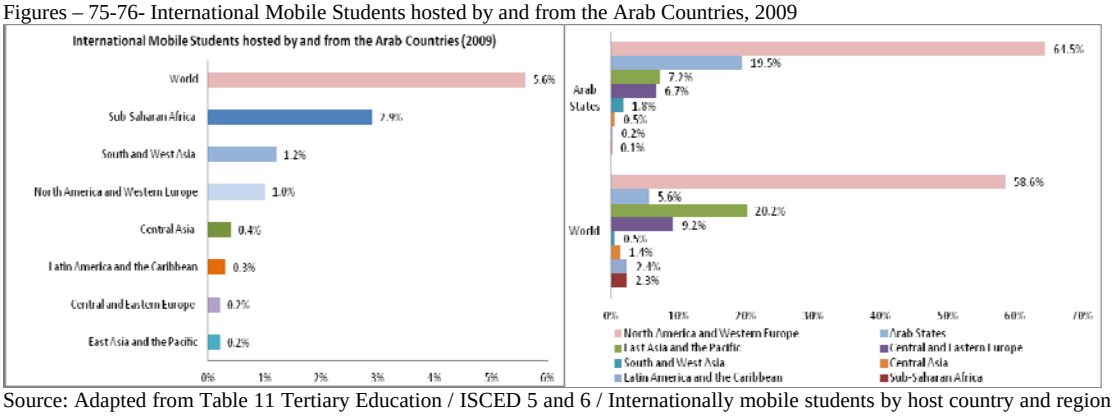
[99] Tertiary Education / ISCED 5 and 6 / International flows of mobile students, 2009

Figures -73-74- Stock and education level of Egypt, Jordan and Morocco migrants in OECD countries (aged 15 years and above), 2009



Source: Adapted from UNDP-Human Development Report 2009 "Overcoming barriers: Human mobility and development: Table C - Education and employment of international migrants in OECD countries, pp. 152-153.

Figures – 75-76- International Mobile Students hosted by and from the Arab Countries, 2009



Source: Adapted from Table 11 Tertiary Education / ISCED 5 and 6 / Internationally mobile students by host country and region of origin / 2009, pp. 190-191, 198-199.

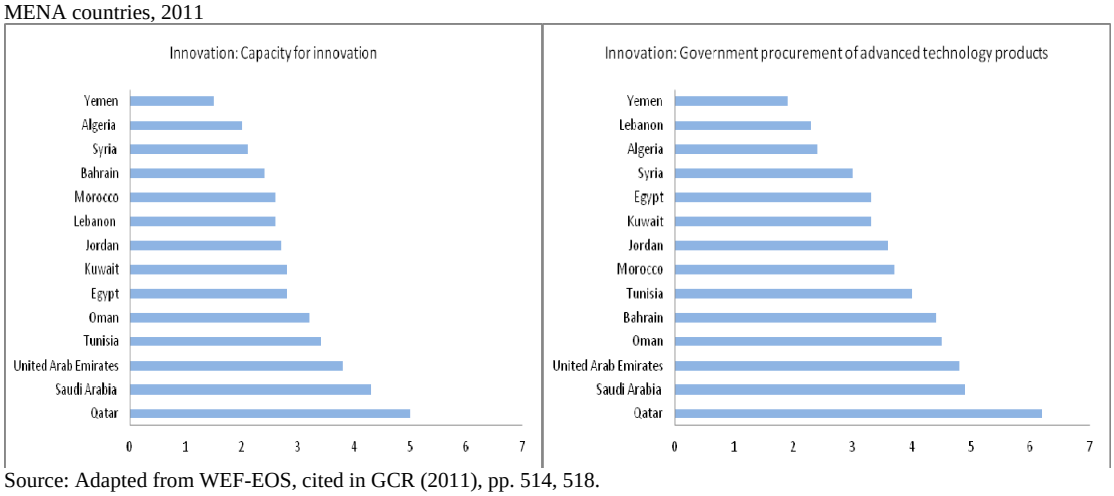
3. 5. Factors enable /impede university industry linkage and R&D in the MENA countries

Some studies in the MENA region discuss the factors that hampered the university-industry linkage and R&D, which is important channel of knowledge transfer. For instance, "most [MENA] countries have focused first on creating technology transfer units in universities and high engineering schools, these units have great difficulty in doing their job. Apart from institutional difficulties in the administrative management of technology transfers, enterprises (mainly SMEs) are less likely to address to a university or a technical centre." (ESTIME, 2007)[100] "The [MENA] region is particularly lagging behind others (score of 3.7 against a World 8.1) in the field of innovation –low levels of R&D funding and low efficiency, insufficient clustering between enterprises and research institutions, nascent policies and financial, both public and capital venture, instruments to support innovation (Figures 77-82), but seems to realize it with the launch of assessment of innovation policies." Zeidane (2011)[101]

[100] See ESTIME Report (2007), pp. 36-37.

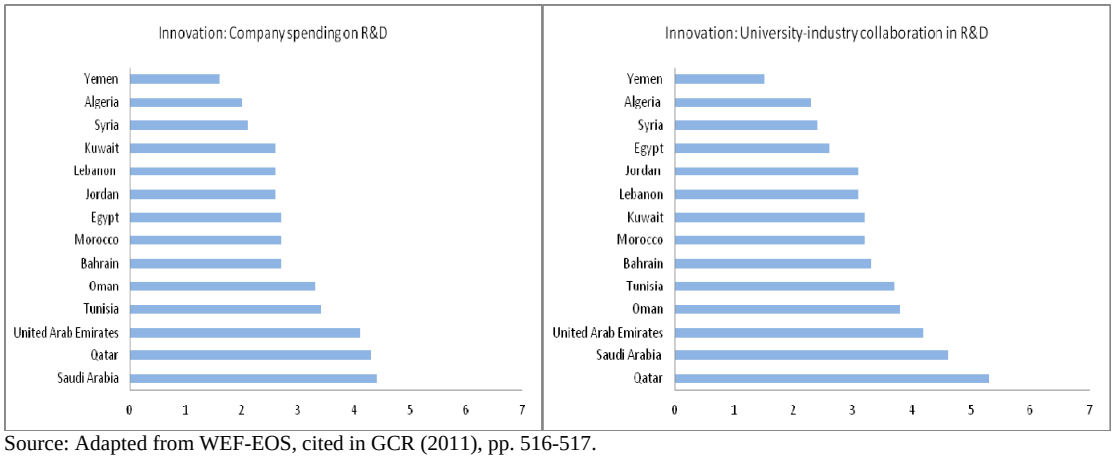
[101] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region" the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp.3.-4.

Figures -77-78 - Innovation: Capacity for innovation and government procurement of advanced technology products in the MENA countries, 2011



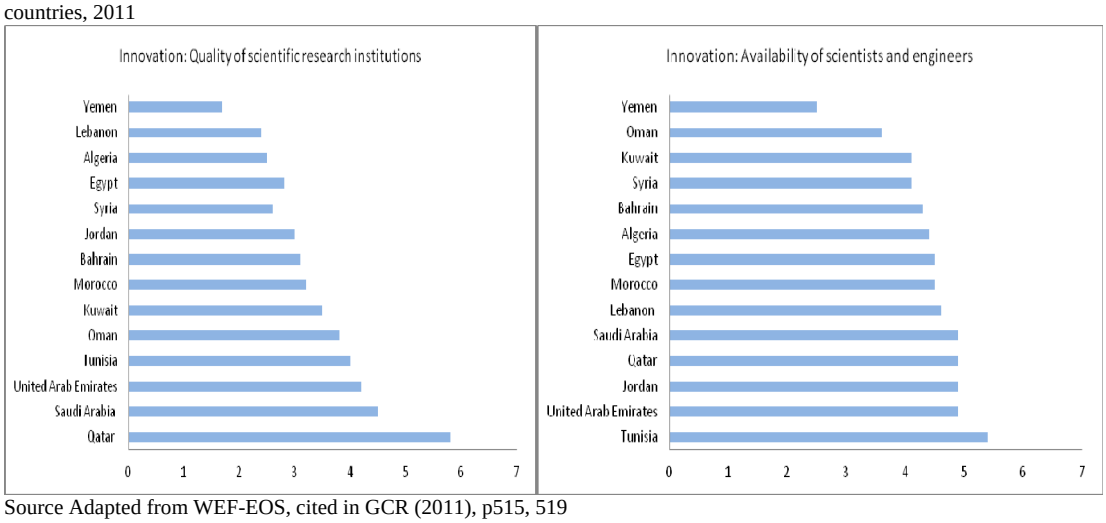
Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 514, 518.

Figures 79-80 - Innovation: Company spending on R&D and University-industry collaboration in R&D in the MENA countries, 2011



Source: Adapted from WEF-EOS, cited in GCR (2011), pp. 516-517.

Figures 81-82 – Innovation: Quality of scientific research institutions and availability of scientists and engineers in the MENA countries, 2011



Source Adapted from WEF-EOS, cited in GCR (2011), p515, 519

4. Factors enable /impede Knowledge Transfer in Egypt

Based on the above results from the international and MENA literature, this section examines the case of Egypt. Before discussing the factors enable /impede absorption capacity and knowledge transfer channels, it is useful to start by explaining the general socio-economic characteristics of

Egypt. Next, we examine the link between economic characteristics and the factors enable /impede absorption capacity and knowledge transfer channels in Egypt.

4. 1. General socio-economic characteristics of Egypt

The general socio-economic characteristics of Egypt indicate great diversity between Egypt compared to other MENA, Arab and world countries in terms of population, standard of economic development defined by Gross National Income and GDP per capita and human development index. Data from the United Nations Development Programme (UNDP)-Human Development Report (HDR) (2011) explains that on average Egypt has a higher population coupled with a lower standard of economic development. The World Bank classification of economies and the UNDP put Egypt among the lower-middle income bracket and among the medium human development respectively. Moreover, UNDP-Human Development Index (UNDP-HDI) shows that the average literacy rate and combined enrolment ratios of Egypt are lower than those of other advanced world countries. According to UNDP-HDR (2011), in terms of UNDP-HDI Egypt is ranked 113 out of 187 World countries. Furthermore, Egypt has continued to suffer from high rates of poverty, unemployment and debt. For instance, according to the World Bank-World Development Indicators (WB-WDI) data for (2011) indicates that in Egypt poverty rates increased from 16.7% in 2000 to 19.6% and 22% in 2005 and 2008 respectively.

"Egypt ranks 81st among 139 countries. The country's main competitive strengths are the sheer size of its market (26th) that allows businesses to exploit economies of scale, the fairly well-developed private institutions (60th) that ensure good governance, as well as satisfactory transport infrastructure (56th overall). The challenges, on the other hand, are numerous. The labour market continues to be overregulated, which reduces its ability to properly allocate and employ human resources. The country is among the poorest performers in the GCI sample in the efficiency of using talent (132nd). Although some progress has been achieved, the continuing labour market rigidities are worrisome because of the widespread unemployment among young people. Furthermore, the solvency of Egypt's banking system, despite some improvements, continues to be cause for concern, as reflected in the 99th position in the ranking."[102] "Out of 142 countries, Egypt occupies the 94th position. [due to the impact of Arab Spring] and the weakening institutional environment, the Global Competitiveness Index (GCI) (2011-2012) ranking dropped considerably – by 13 places for Egypt as compared to (2010-2011). One interpretation is that the drop reflects higher uncertainty in Egypt during the early transition process. Egypt faces numerous challenges, in particular those related to the institutional environment and inefficient labour market, which suffers from an inefficient use of available talent and rigid labour regulations and the skill mismatch that hinders additional employment creation. The macroeconomic situation in Egypt is worrisome. Although public debt has been reduced in the past, the widening fiscal deficit and resulting inflationary pressures are expected to continue to burden the economy. In fact, such pressures and are likely to increase in the coming years, as additional spending becomes necessary

[102] See the World Economic Forum (2010) "The Arab World Competitiveness Review 2010," pp. 17-18.

to address concerns about social injustice. Along with job creation, the most immediate focus should be on addressing security problems and lingering political uncertainty, which have recently limited economic growth."[103]

4.2. Factors enable /impede Knowledge Transfer in Egypt

From the available studies and statistics we explain the factors that hampered absorption capacity and knowledge transfer channels in Egypt (Tables 10-11, Figures 83-95).

Table 10 – Factors that hampered competitiveness and important channel of knowledge transfer in Egypt, 2007-2011

Indicators	2007[a]	2008[a]	2009[a]	2010[a]	2011[b]
Macroeconomic environment					
Government deficit	-5.7	-6.8	-6.6	-8.3	-7.7
Inflation	11	11.7	16.2	11.7	11.7
Government debt (hard data)	105.8	85.9	80.1	73.8	
Higher education and training					
Extent of staff training	3.5	3.4	3.3	3	
Local availability of specialized research and training services	3.6	3.9	4.1	3.9	
Quality of the educational system	2.4	2.6	2.5	2.3	
Tertiary enrolment (hard data)	34.7	34.7	28.5	28.5	
Labour market efficiency					
Reliance on professional management	3.5	3.7	4.1	3.5	
Brain drain	2.1	2.4	2.5	2.5	
Good market efficiency and technological readiness					
Business impact of rules on FDI	4.9	5	4.6	4.2	
Firm-level technology absorption	4.8	5.1	5	4.7	
FDI and technology transfer	5.1	5.1	4.9	4.7	
Good market efficiency and trade					
Trade Tariff rate	21.8	22.2	13.8	14.7	
Prevalence of trade barriers	3.9	3.9	4	4.1	
Imports as a percentage of GDP	34.8	45.5	33.8	30	
Exports as a percentage of GDP	31.5	45.8	37.8	23	
Innovation					
Capacity for innovation	2.9	2.6	2.5	2.8	
Quality of scientific research institutions	3.4	3.2	2.9	2.8	
Company spending on R&D	3.3	3.2	3	2.7	
University-industry research collaboration	3	3.1	2.8	2.6	
Government procurement of advanced technology products	3.7	3.5	3.4	3.3	
Availability of scientists and engineers	4.5	4.3	4.9	4.5	
Financial market development					
Venture capital availability	3.4	3.4	3	3	
Availability of financial services	3.5	3.8	4.8	4.4	
Institutions and infrastructure					
Intellectual property protection	3.6	3.7	3.6	3.3	
Quality of overall infrastructure	3.9	4.4	4.3	3.9	

Source: (a) GCR (2008-2011), (b) the Millennium Challenge Account MCI (2012), Country Scorebook (2012), p.145.

4. 1. Factors enable /impede FDI and business environment in Egypt

Several studies in Egypt discuss the factors that hampered FDI, which is important channel of knowledge transfer. For instance, the literature "assesses the effectiveness of FDI incentives in Egypt and finds that the low FDI inflow in Egypt is due to the insufficiency of the business environment and the ineffectiveness of the incentives." (Massoud, 2003)[104]

The literature discusses the actual impact of FDI for improving the International Technology Transfer (ITT) in Egypt (Kadah, 2003). The literature finds that "there is a strong potential for improving advanced ITT by foreign investors in Egypt through enhancing local technological capacity, offering investment incentives linked to ITT activities, introducing new local content requirements, using ITT requirements and protecting of intellectual property rights. [This requires] improving local absorptive capacity to enhance the technological competitiveness of the Egyptian

[103] See the World Economic Forum (2011) "Arab World Competitiveness Report 2011-2012," pp. 15, 21.
[104] See Nada Massoud (2003) "Assessment of FDI incentives in Egypt," ERF Working Paper No. 0336, pp. 3, 6-7, 12.

economy. One of the problems of Egypt in this area is the existence of a big gap between science and technology institutions on the one hand, and the productive sector on the other hand. In addition, although Egypt is rich in human capital, certain market needed skills are missing. Most importantly, a strategy should be developed to link R&D institutions to the productive sector. In addition, Egypt needs to develop skills and know-how in areas such as IT, production techniques and methods, establishing and managing competitive businesses, analysing market needs, and developing appropriate business strategies. In particular, middle-level supervisory skills and other market needed skills should be adequately developed. UNCTAD (1999a) studies the FDI environment in Egypt and states that Egypt enjoys an attractive base of human capital and technological infrastructure, which refers to a high technological absorptive capacity. There is a high stock of human capital and wide network of R&D institutions. On the other hand, the country suffers from inefficient national technology management, marginalisation of ITT, inadequate public and private R&D resources, and weak integration between R&D institutions and industry. It can be said that Egypt invests heavily in human capital and R&D institutions, but spends very little on actual R&D activities.[105] In addition, although there is a relatively high stock of human capital, the abundance of skills is largely confined to technical and engineering personnel. Repeatedly, foreign investors complain about a shortage of middle-level and supervisory managerial skills, which is generally common to African countries (UNCTAD, 1999a; DEPRA, 1998). Thus, there is a need to attempt the path of Southeast Asian countries, such as Malaysia and Singapore, in inducing the private sector (local and foreign) to develop high-quality specialized training facilities that can contribute to fulfilling the different needs of the productive sector. Though a modest contribution, FDI flows to Egypt have contributed to domestic technological development, especially in such areas as productivity and managerial skills.[106] In a survey of foreign firms working in Egypt conducted by the UNCTAD in 1997, in association with the Economic Research Forum (ERF) of North Africa and the Arab Countries, three major technological benefits of FDI were signalled: productivity improvement, product development, and sharing of R&D activities (UNCTAD, 1999a). In addition, particularly in Upper Egypt, foreign firms use labour-intensive technologies, which contribute to governmental efforts to alleviate unemployment and enhance human capital development. Unfortunately, ITT activities by foreign investors in Egypt are largely limited to low-technological-content assembly operations (Peoples Assembly, 2000). Working under minimal performance requirements, MNCs tend to focus on exploiting the large size of the Egyptian market, with little interest in exportation or advanced technology transfer. In a study presented to the UNCTAD Working Group on the Interrelationship between Investment and Technology Transfer (between January 1993 and March

[105] The private sector invests very little in R&D, 0.04% of GNP in 1990, and the R&D expenditure of both the public and private sectors is under the developing countries' benchmark of 1% of GDP (UNCTAD, 1999a).

[106] This is very obvious in industries such as pharmaceuticals, textiles and garments and electronics and information technology. Outstanding examples include wholly-owned subsidiaries, such as Oracle, Bechtel, IBM, Nestle, 3M, Shell and Xerox as well as majority-owned subsidiaries, such as Glaxo Welcome (90%), Novartis (70%), Lecico (75%) and Eli Lilly (85%). These firms have all transferred some of their state-of-the-art technologies. In addition, joint ventures such as Suzuki and GM have been of significant importance for technological learning by national firms. Most joint ventures however are subject to minority ownership constraints, which might have deterred transfer of latest technologies (UNCTAD, 1999a).

1994), two major MNCs working in Egypt were examined as to their contribution to domestic technological development (UNCTAD, 1995a). Science-based activities of the examined MNCs were predominantly confined to field-testing of products for demonstration purposes, training programs, and environmental consciousness activities. The study could not trace any significant R&D efforts aimed at developing new products or processes. A major weakness of FDI as a source of ITT to Egypt is the relative absence of upstream and downstream linkages with domestic firms even in linkage-intensive industries, such as automobiles and consumer durables (UNCTAD, 1999a). As a result, FDI has weak domestic externalities. Most Egyptian manufacturing enterprises are small and medium-sized enterprises, which can strongly feed FDIs, but lack requisite operating technologies, managerial skills, and technical expertise. This is why they tend to have difficulties meeting the quality standards and delivery requirements of foreign firms. So, there is a need to strengthen FDI local linkages, particularly in industries with high FDI and innovation potential such as agronomy, textiles, and information technology, through supporting small and medium-sized enterprises and requiring certain local content ratios in exchange of adequate advantages (UNCTAD, 1999a)." (Kadah, 2003).[107]

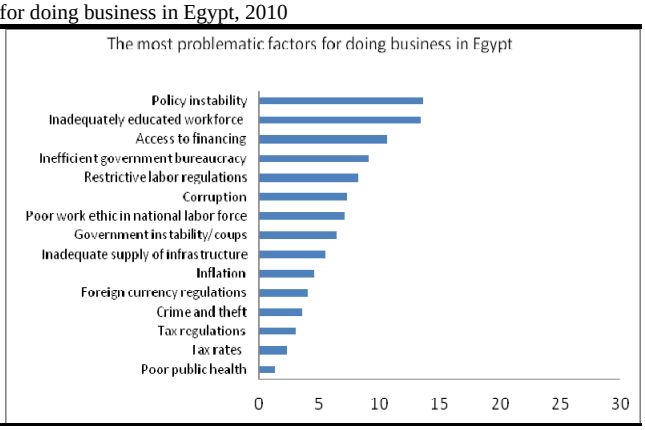
In Egypt, the most important enabling factors for FDI are the large market size and relatively high firm level technology absorption and high protection for investor. The impediment factors are: economic factors: macroeconomic instability and unfavourable environment (due to high fiscal deficit and high inflation rate) and institutional factors (due to corruption, low accountability, and poor IPR protection), which are all below the international standards. For instance, according to the MCA country scorebook (2012) Egypt performance is below the median and do not meet the international performance standard in terms of institutional factors measured by control of corruption (-0.07) and voice and accountability (-1.04) and economic factors measured by trade policy (74.0) and fiscal policy (-7.7).[108] FDI is impeded not only by macroeconomic factors (high fiscal deficit and inflation rate) but also by other factors such as poor quality of infrastructure, poor R&D spending and cooperation, poor technological readiness, poor ICT infrastructure, poor capacity to innovation, poor goods market and labour market efficiency, skill gap and mismatch, poor quality of education and training, high tariff rate and prevalence of trade barriers, low financial development as measured by inadequate availability of financial services and venture capital (Figures 84-87). FDI is also hampered by poor business environment. For instance, GCR (2011) shows the most problematic factors for doing business in Egypt (Table 11, Figure 83). For instance, from the list of 15 factors, the six factors that had most represented the biggest problematic factors for doing business in Egypt are policy instability (13.6), inadequately educated workforce (13.4), access to financing (10.6), inefficient government bureaucracy (9.1), restrictive labour regulations (8.2) and corruption (7.3) respectively. These are followed by less important factors such as poor work ethic in national labour force (7.1), government instability/coups (6.4),

[107] See Mohamed Mansour Kadah (2003) "Foreign Direct Investment and International Technology Transfer to Egypt," ERF Working Paper No. 0317, pp. 6-7.
[108] See the Millennium Challenge Account - Country Scorebook (2012), p.145, see also MCC's website: www.mcc.gov.

inadequate supply of infrastructure (5.5), inflation (4.6), foreign currency regulations (4), crime and theft (3.6), tax regulations (3), tax rates (2.3) and poor public health (1.3). In addition FDI is also hampered by the legal issues. "The quality of the law making process suffers from weak implementation capacities. This is particularly obvious in the case of the customs law, taxes law, competition law, labour law, and information act and standards. The law making process also suffers from severe weaknesses in the coordination among ministries and public authorities, the export promotion law being one example. Finally, knowing the market impact of laws and consulting on these and other issues with other stakeholders is ad hoc, sporadic, and lacks transparency; the case of the intellectual property rights law and the investment law are two examples thereof…. The main problem is that Egypt lacks the human capacity to implement such law and especially in the field of copyrights." Ghoneim (2005)[109]

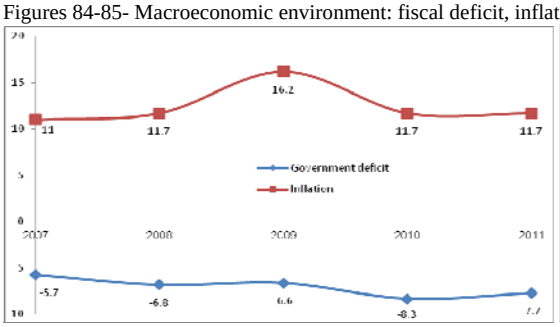
Table – 11- Figure 83- The most problematic factors for doing business in Egypt, 2010

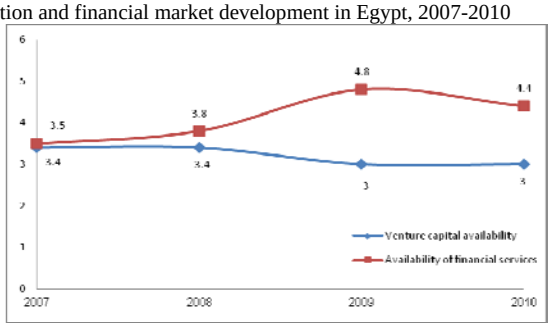
(a) Egypt	
Policy instability	13.6
Inadequately educated workforce	13.4
Access to financing	10.6
Inefficient government bureaucracy	9.1
Restrictive labour regulations	8.2
Corruption	7.3
Poor work ethic in national labour force	7.1
Government instability/coups	6.4
Inadequate supply of infrastructure	5.5
Inflation	4.6
Foreign currency regulations	4
Crime and theft	3.6
Tax regulations	3
Tax rates	2.3
Poor public health	1.3



Source: GCR (2011), pp. 168-169.

Figures 84-85- Macroeconomic environment: fiscal deficit, inflation and financial market development in Egypt, 2007-2010

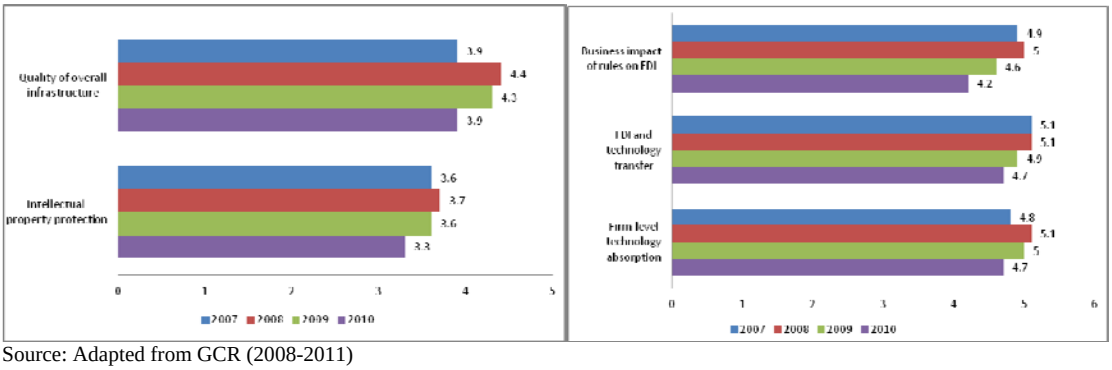




Source: Adapted from GCR (2008-2011)

Figures – 86-87- Institution, infrastructure, good market efficiency and technological readiness in Egypt, 2007-2010

[109] See Ahmed Ghoneim (2005) "Law-Making for Trade Liberalization & Investment Promotion in Egypt" in Noha El-Mikawy (ed.) (2005) "Governance of Economic Reform: Studies in legislation, participation and information Egypt, Morocco and Jordan," Economic Research Forum, December, 2005, pp, 35-66, pp.48, 59.

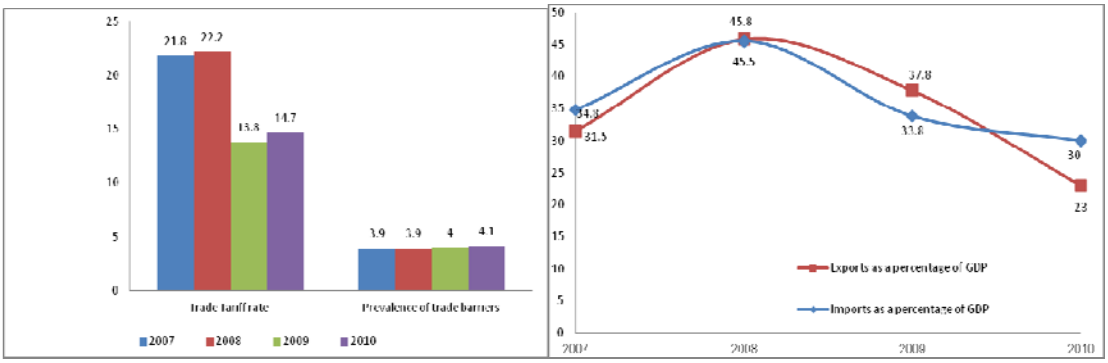


Source: Adapted from GCR (2008-2011)

4. 2. Factors enable /impede international trade in Egypt

Available statistics in Egypt show the factors that hampered trade, which is important channel of knowledge transfer. Egypt liberalization and trade performance (share in world export market) is below that of other MENA countries. Despite recent trade liberalization efforts, generally open to free trade Egypt continues to maintain relatively high tariffs and nontariff barriers. As a result, for the case of Egypt, the overall degree of trade restrictiveness is clear from the low trade performance as measured by the exports as percentages of GDP, the high prevalence of trade tariffs and the nontariff barriers that are greater to MENA countries (Figure 88-89).[110]

Figures- 88-89- Good market efficiency: prevalence of trade tariffs, trade tariff barriers and the international trade in Egypt, 2007-2010



Source: Adapted from GCR (2008-2011)

4. 3. Factors enable /impede ICT in Egypt

Several studies in Egypt discuss the factors that hampered ICT, which is important channel of knowledge transfer (Figures 90-91). For instance, the literature indicates that "a challenge for the ICT market in Egypt is to preserve the ICT skilled personnel who can usually earn much higher wages in other countries, so many of them leave. [In addition to the problem of skill gap and mismatch between educational attainment and market needs] as in most cases, graduates, once entering the employment market, they face the inadequacy between what they have learned academically and the tools that the professional life requires. Durate and Simoes (2004) examine the role of human capital as a facilitator of technological diffusion i.e., the transfer of technology from developed countries to developing countries and as a determinant of the absorptive capacity

[110] See George T. Abed and Hamid R. Davoodi (2003) "Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund, pp. 21-22.

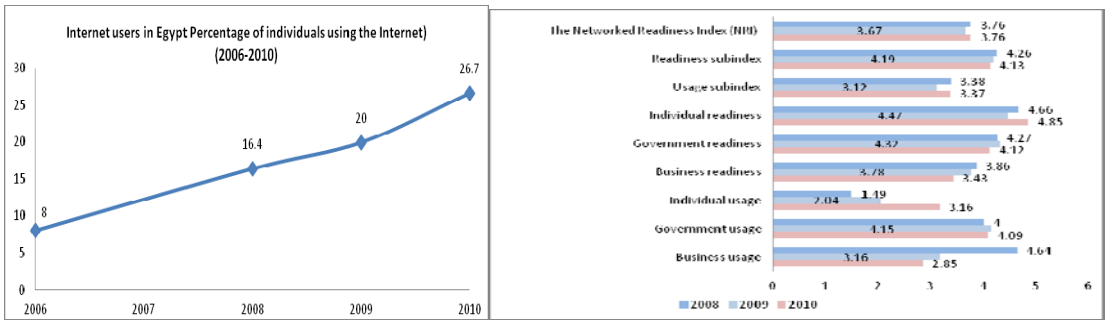
of the recipient in developing Mediterranean countries including Egypt. The results support higher education as a main determinant of ICT diffusion. ICT diffusion in Egypt is below the MENA region average. Disadvantaged areas which embrace the majority of the population are not benefiting enough from the projects in place to diffuse the technology. Besides, SMEs which constitute the majority of the business sector need to be empowered and should be targeted by the public policies and by the business sector.[111] Within household, low income and the high percentage of illiteracy among the Egyptian population and of English-language ignorance constitute the major obstacles for ICT diffusion. Concerning the business sector's adoption; finance, the level of education of the personnel, lack of enough awareness of the financial benefits of ICTs' applications or of their potential uses in various sectors of activity and lack of incentive to invest in ICT constitute the main obstacles. It is noticed that Internet usage in 'developing online products' and 'R&D' activities is limited. This means that the Egyptian business sector is not enough integrated within the world open source innovation process. Usages need to be developed concerning e-commerce and open source innovation which can help develop SMEs business." (El-Demery, 2009)[112] The use of ICT is impeded by "the lacks of the physical technological infrastructure and the technological literacy, which are quite a hindrance to demand for information and knowledge dissemination. In addition to the lack of human resources, as the country still suffers from high illiteracy rates and the educational system does not depend on projects, problem solving or library and field research…. Demand for information is hampered by bad quality of education,… Weak proficiency in English has reduced demand for information on the web, discouraging demand for electronic suppliers….The existence of relatively big private business has positively influenced the demand for economic information. However, the major problem is the weakness of the critical mass of the Egyptian private sector, namely micro and small enterprises, with respect to their demand for information" El-Mikawy and Ghoneim (2005)[113] In Egypt, ICT is hampered by poor quality of infrastructure, skill gap and mismatch, poor quality of education, high illiteracy and poverty rates, low per capita income level, poor macroeconomic environment, poor NRI, readiness and usage sub- index, poor capacity to innovation and poor IPR protection.

Figures –90-91- ICT: Internet users, Networked Readiness Index, Readiness and Usage subindex in Egypt, 2006–2010

[111] A good example of targeting SMEs is Oracle Company's strategy. The company is forecasting that SMEs would emerge as the main drivers of Egyptian applications' spending, and is promoting a tailored approach to the SMEs community.

[112] See El-Demery Noha (2009) " ICT Diffusion in Egypt: Market Dynamism and Public Policies," May 2009, pp. 8, 11, 14-15, 17.

[113] See Noha El Mikawy and Ahmed Ghoneim (2005) "The Information Base, Knowledge Creation and Knowledge Dissemination in Egypt" in Noha El-Mikawy (ed.) (2005) "Governance of Economic Reform: Studies in legislation, participation and information Egypt, Morocco and Jordan," Economic Research Forum, December, 2005, pp, 355-385, pp. 375-379.



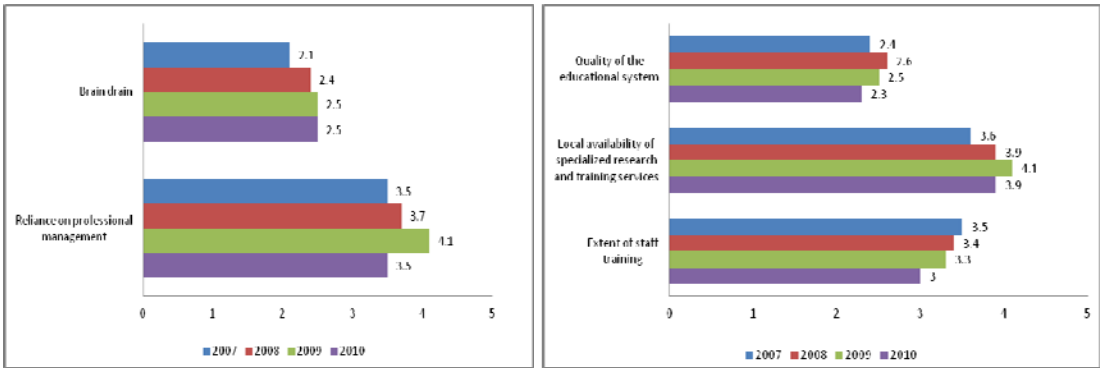
Sources: Adapted from GITR (2008-2010)

4. 4. Factors enable /impede education and human capital mobility and brain drain in Egypt

Several studies in Egypt discuss the factors that hampered education and human capital mobility, which is important channel of knowledge transfer. For instance, knowledge transfer through utilization of human capital and education in Egypt is hindered by the poor quality of education, the high incidence of skill gap and mismatch and brain drain. For instance, the skills gaps measures estimated by Schwalje (2011a; b) consist of global skills gaps measure that implies that in Egypt near to one third of attained skills do not match the required skills (30%) and regional skills gaps measure that implies that near to two-thirds of attained skills do not match the required skills (66%) based on the World Bank Enterprise Survey data and MBRF/PWC Arab Human Capital Challenge report respectively (Table 5, Figure 71), this implies that the high skill gap in Egypt that is above the average level for the Arab countries.[114] Knowledge transfer through utilization of human capital mobility in Egypt is also hampered by the incidence of high brain drain. For instance, Docquier and Marfouk (2004) find that with the highest proportion of skilled emigrants in the total emigration stock in OECD (59 percent) Egypt is ranked at the top of the MENA countries, and it is ranked 19 among the top 30 world countries among the 195 world countries studied. Based on the 1998 Egypt Labour Market Survey, it is clear that, given the high unemployment rates for the educated in Egypt, they are the most likely to emigrate. In Egypt the remunerations were dreadfully eroded by price rise; an important emigration takes place continuously; and professionals are often busy with parallel tasks (contracts for teaching or doing research elsewhere) to make their living. Among the Arab countries, Egypt is hit by an exodus and brain drain as the profession is rather poorly treated, a few years ago, there were as many Egyptian scientists employed in R&D through the world as there were (FTE) in their own country;. …. By 2000 official statistics from NSF (USA) counted 13,000 Egyptian scientists and engineers established in USA, out of whom 5,000 were employed in the R&D sector. This could amount to 35,000 Egyptian highly skilled in S&T established in developing countries. Therefore, in Egypt, the utilization of education and human capital is hampered by the increasing trend of brain drain, poor ICT infrastructure, incidence of high skill gap and mismatch, declining trend and poor quality of education and low and declining enrolment in tertiary education (Figures 92-93).

Figures -92-93- Education, human capital, labour market efficiency and brain drain in Egypt, 2007-2010

[114] See Wes Schwalje (2011a) "Examining Global Skills Gaps: How Skills Gaps Impact Firm Performance in the Arab World," International Human Resources Conference and Exhibition Dubai, United Arab Emirates, January 19-20, 2011, pp. 6-7.

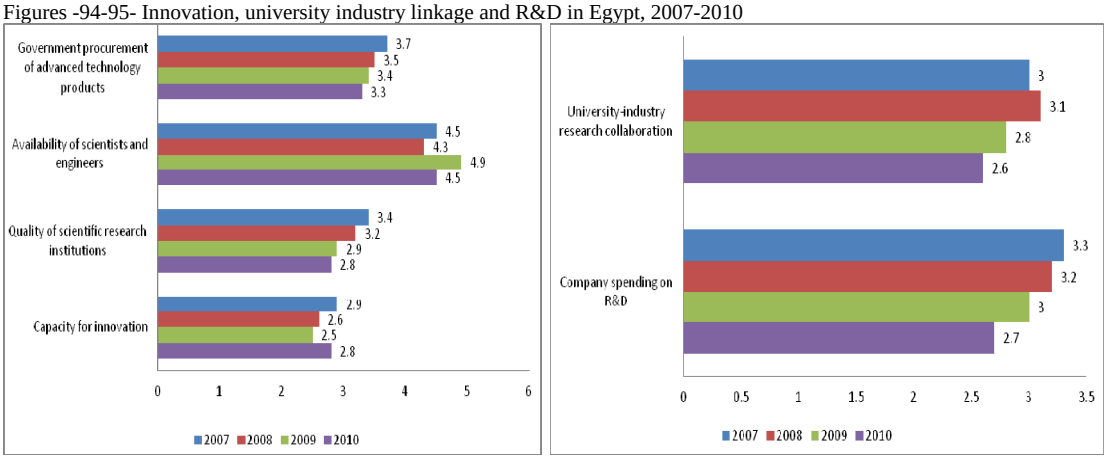


Source: Adapted from GCR (2008-2011)

4. 5. Factors enable /impede university industry linkage and R&D in Egypt

Available statistics and studies in Egypt show the factors that hampered university-industry linkage and R&D, which is important channel of knowledge transfer. For instance, the factors that hampered the knowledge transfer channels through university-industry linkage and R&D in Egypt are related to low R&D spending by private sectors. The literature indicates that "there is a high stock of human capital and wide network of R&D institutions, but, Egypt suffers from inefficient national technology management, marginalisation of ITT, inadequate public and private R&D resources, and weak integration between R&D institutions and industry. Egypt invests heavily in human capital and R&D institutions, but spends very little on actual R&D activities." (Kadah, 2003). [115], [116] Egypt is similar to other MENA countries is particularly lagging behind others world countries in the field of innovation- low levels of R&D funding and low efficiency, insufficient clustering between enterprises and research institutions, according to the Global Innovation Index Report (2011), Egypt scored 29.21 and ranked 87 out of 125 worldwide countries. In Egypt, university-industry linkage and R&D are hampered by poor ICT infrastructure, brain drain, poor IPRs protection, poor private R&D spending (as the majority of the business sector are SMEs), poor capacity for innovation and poor quality of scientific research institutions (Figures 94-95).

Figures -94-95- Innovation, university industry linkage and R&D in Egypt, 2007-2010



Source: Adapted from GCR (2008-2011)

[115] The private sector invests very little in R&D, 0.04% of GNP in 1990, and the R&D expenditure of both the public and private sectors is under the developing countries' benchmark of 1% of GDP (UNCTAD, 1999a).

[116] See Mohamed Mansour Kadah (2003) "Foreign Direct Investment and International Technology Transfer to Egypt," ERF Working Paper No. 0317, pp. 6-7.

5. Conclusions and Policy Recommendations

This paper gives overview of knowledge transfer and shows the factors enable/impede absorption capacity and knowledge transfer in MENA region, with particular reference to the case of Egypt.

The study presented in this paper is organised in two parts and five sections, **Part One** includes Sections 2-3 and **Part Two** includes Section 4. Section 1 presents an introduction and briefly shows the aims, methodology and structure of the study. Sections 2-4, examine the major channels for international knowledge transfer focusing on FDI, international trade, ICT, education, human capital mobility and university-industry linkage and investigate the factors enable/impede absorption capacity and knowledge transfer as discussed in the studies in the international, MENA and Egypt literature. Section 5 provides the conclusions and policy recommendations.

Section 2 reviews the international literature on absorption capacity and international knowledge transfer channels including FDI, international trade, ICT, education, human capital mobility and university-industry linkage. We explain that the international literature on technology and knowledge transfer identifies different channels of international technology and knowledge transfer in different countries and comes to mixed results regarding the effectiveness of different channels of international knowledge transfer. We explain that apart from the increasing debate in the literature concerning the effectiveness of different channels of knowledge transfer, most studies in the international literature in knowledge transfer are consistent with the view that the attainment of certain minimum threshold levels of absorption capacity (e.g. human capital and R&D) is a precondition necessary for effective benefit from knowledge and technology transfer.

Sections 3-4 examine the factors enable/impede absorption capacity and knowledge transfer channels (FDI, international trade, ICT, education, human capital mobility and university-industry linkage) in the MENA region and Egypt. We find that the factors hindering absorption capacity and knowledge transfer in the MENA countries and Egypt are related to institutions, infrastructure, macroeconomic environment, higher education and training, goods market efficiency and labour market efficiency, financial market development, technological readiness and capacity for innovation. We find that knowledge transfer through utilization of human capital and education in the MENA region is immensely impeded by the poor quality of education, the high incidence of skill gap, mismatch and brain drain. We find that knowledge transfer through utilization of ICT in several MENA countries is immensely impeded by the insufficient resources, poor ICT infrastructure, poor NRI and NRI component sub-indexes: environment (political and regulatory, market and infrastructure), readiness and usage by individual, business and government, especially business usage, which are all low by international standards. We find that knowledge transfer through utilization of university-industry linkage is immensely impeded by low public-private R&D spending and poor capacity for innovation in the MENA countries.

Motivated by the lessons learned from the international and MENA literature, we observe that the literature in the MENA region affirm that for overcoming the detrimental factors that hampered the knowledge economy in the MENA region and promoting the absorption capacity the necessary

condition for the MENA region is to create the appropriate and enabling environments. This requires, for instance, reviewing the existing development plans to develop vision and implement rational policies to harmonise them with the demand of the knowledge economy, promoting organizational context that consolidate linkages between R&D institutions and the industrial, service and business sectors, allocating of sufficient financial and human resources, investing in building high human capital and local knowledge workers, promoting S&T and ICT infrastructure, promoting appropriate institutions and legislation, enhancing entrepreneur culture and creating the enabling socio-economic and political contexts conducive to knowledge transfer and promoting absorption capacity. This implies that prioritising of enabling environment, enabling institutions and sufficient legislation are necessary for effective knowledge transfer and promoting absorption capacity.[117] The Arab countries should stimulate local efforts and incentives for building and transferring knowledge and support the institutions for the creation and transfer of knowledge, and provide institutional support in the form of subsidies and incentives to knowledge components (education, R&D, and ICT).[118] The Arab countries must restructure higher education and science policies, socio-economic, political and institutional contexts and benefit from cooperation with the regional and global organizations to contribute positively to the restructuring of higher education and science policies, and scientific research in the Arab region.[119] The priority of institutional reforms that would be needed for the establishment of a knowledge-based development model should be built around four pillars: the economic and institutional regime, education and training, innovation and ICTs. The MENA countries need to develop comprehensive plans to promote innovation building on indigenous and foreign knowledge and increasing the efficiency of public interventions, especially in the R&D.[120] The creation of enabling environment in turn will most probably encourage effective knowledge transfer from European countries to MENA region through four major channels: FDI, international trade, ICT and human capital mobility and scientific cooperation in education and research.

We find that the enabling environment for absorption capacity and knowledge transfer requires improvement in institutions, infrastructure, macroeconomic environment, higher education and training, goods market and labour market efficiency, financial market development, technological readiness, innovation and effective utilization of human capital and education by improving the quality of education, reducing the incidence of skill gap, mismatch and brain drain in the MENA region. The MENA region needs to improve the knowledge economy index, mainly, development

[117] See for instance, the United Nations Development Programme-Arab Human Development Report (2003) and Mohammed bin Rashid Al Maktoum Foundation "the Arab Knowledge Report, 2009".

[118] See Samia (2012), "The Incidence and Transfer of Knowledge within the Arab Societies," Paper accepted for publication (published online: 11 January 2012) and forthcoming in *the Journal of the Knowledge Economy*, 2012, to be Published by Springer, Germany, December, Vol. 3, No. 1, March 2012 (forthcoming 2012). See also Samia (2010) "The incidence and transfer of knowledge in the Arab countries" (UNU-MERIT Working Paper 2010-64, December 2010, Maastricht, the Netherlands.

[119] See Samia (2011a) "National, Regional and Global Perspectives of Higher Education and Science Policies in the Arab Region" *Minerva: A Review of Science, Learning and Policy*, Minerva, Springer, Germany, Vol. 49, No. 4, December 2011, pp. 387-423, p. 392.

[120] See Zeine Zeidane (2011) "Institutional Reforms for a Knowledge Economy Model in the Arab Region" the Executive Summary in English of the Report written in French, Report presented at the World Bank and Center for Mediterranean Integration (CMI) workshop in Knowledge Economy in the MENA Region, CMI, November, 2011, Marseille, France. pp.2.-4.

of their education systems to confront the new challenges related to the increasing importance of knowledge economy. Meeting this challenge requires the education systems to produce competent and flexible human capital and requires financing, which is difficult to secure on the basis of the current patterns of expenditure and sources of funding. The challenge here is to find ways to mobilize resources without compromising equity and the quality of education. Thus, the region needs to travel a new road. The new road has two features: the first is a new approach to education reform in which the focus is on incentives and public accountability, besides the education process itself; the other feature concerns closing the gap between the supply of educated individuals and labour demand, both internally and externally.[121] To boost the efficiency the MENA countries need to streamline the management of their education systems, encourage private participation in the education systems, and adapt education programs to the demands of a modern economy.[122]

To attract FDI the MENA region should remove all barriers to trade, develop the financial systems, reduce the level of corruption, improve policy environment, build appropriate institutions and to adopt policies aimed at reducing the size of the government through privatization and reducing macroeconomic instability.[123] The MENA countries need to improve investment in human capital, quality of skills of the labour force and absorption capacity of domestic economies, to reduce the complexity of their overlapping trade agreements, reduce the administrative costs of obtaining access to neighbouring markets by removing licensing requirements and reducing the costs of complying with rules of origin, and improve business environment.[124]

The MENA countries need to strengthen ICT by improving ICT infrastructure, ICT literacy, financial and human resources and public-private partnership in ICT sector. [This implies the importance of] improving access to information, reducing Internet subscription costs and prices to level affordable by large segments of the population; increasing the number of public access centres, continue liberalization of the telecommunication sector, reducing censorship and blockage of websites to a minimum; increasing availability of digital Arabic content in order to encourage usage by large segments of the population; and providing free access to scientific content on the Internet in order to encourage research and innovation. [In addition to] supporting the provision of enabling environment to ICT acquisition and dissemination through establishment of appropriate market, regulatory and infrastructure environments, protection of IPRs, encouraging national and foreign investment in ICT sector; establishing venture capital and investment funds to support the creation of start-ups and SMEs in ICT sector and encouraging entrepreneurship in the ICT sector through the creation of incubators and science and technology parks.[125] The MENA countries need to enhance ICT by improving NRI, environment, infrastructure, readiness and usage.

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[121] See the World Bank (2008)"New Challenges Facing the Education Sector in MENA," pp, 2-3, 84-86, 110-111.

[122] See George T. Abed and Hamid R. Davoodi (2003)"Challenges of Growth and Globalization in the Middle East and North Africa," International Monetary Fund, pp. 18-20.

[123] See Sufian Eltayeb Mohamed and Moise G. Sidiropoulos (2010) "Another look at the determinants of foreign direct investment in MENA countries: an empirical investigation", *Journal of Economic Development*, Volume 35, Number 2, June 2010, pp. 75-95, 88-89.

[124] See the World Bank (2008)" Strengthening MENA's Trade and Investments Links with China and India," September 2, 2008, Document of the World Bank Social and Economic Development Group, Middle East and North Africa Region, pp. vii, xi.

[125]See ESCWA (2009) "Regional Profile of the Information Society in Western Asia," pp. 11-12, 44-45, 66-67, 77.

Section 4 explains that in Egypt, knowledge transfer through utilization of FDI is impeded by both economic factors due to macroeconomic instability and unfavourable environment (high fiscal deficit, high inflation rate) and institutional factors (corruption, low accountability, poor IPRs protection), which are all below the international standards. FDI is also impeded by poor quality of infrastructure, poor R&D spending and cooperation, poor technological readiness, poor ICT infrastructure, poor capacity for innovation, poor goods market and labour market efficiency, skill gap and mismatch, poor quality of education and training, high tariff rate and prevalence of trade barriers, low financial development as measured by inadequate availability of financial services and venture capital and poor business environment. We find that in Egypt, knowledge transfer through utilization of trade is inhibited by the prevalence of trade barriers, high tariff rate and poor performance of trade policy which is below the international standards. We find that knowledge transfer through utilization of human capital and education in Egypt is immensely impeded by the poor quality of education, the high incidence of skill gap, mismatch and brain drain. We find that in Egypt, knowledge transfer through utilization of ICT is immensely impeded by the insufficient resources, infrastructure, readiness and usage, which are all low by international and MENA region standards, the major obstacles for individual household are the low income level and high illiteracy rate and for the business sector are the poor adoption and lack of resources (human and financial). We find that in Egypt, knowledge transfer through utilization of university-industry linkage is immensely impeded by low public-private R&D spending and poor innovation capacity. For the case of Egypt, we find that the enabling environment for absorption capacity and knowledge transfer requires improvement in the quality of institutions, infrastructure, ICT, sufficiently qualified labour, macroeconomic environment, higher education and training, goods market and labour market efficiency, financial market development, technological readiness and innovation and opening up to international trade. Knowledge transfer through utilization of FDI can be facilitated by the enabling factors for doing business such as ensuring policy stability, sufficiently qualified labour, improving access to financing, avoiding government bureaucracy, avoiding restrictive labour regulations and avoiding corruption respectively. Knowledge transfer through utilization of international trade can be facilitated by removal of trade barriers, tariff rate and improvement of performance of trade policy. Knowledge transfer through utilization of ICT can be facilitated by offering sufficient resources (human and financial), infrastructure, readiness and usage. Knowledge transfer through utilization of human capital and education can be facilitated by improving the quality of education, reducing the incidence of skill gap, mismatch and brain drain. Knowledge transfer through utilization of university-industry linkage can be facilitated by improving public-private R&D spending and improving capacity for innovation.

Specially, for the case of Egypt, the study identifies two main challenges facing promotion of absorption capacity and knowledge transfer. Mainly, from policy perspective the need for firm commitment to institutional reform and better availability, sustainability and efficiency of infrastructure and sound plans and systematic institutions that are needed for promoting the

absorption capacity and knowledge transfer in Egypt. From economic and social development perspectives, the challenge for promotion of absorption capacity and knowledge is that the recent economic crisis, the high incidence of poverty and youth unemployment in Egypt implies competition for the limited financial resources allocated for youth unemployment, poverty, economic growth, promoting absorption capacity and reform of knowledge institutions. The major implication here is that more spending on promoting the absorption capacity and knowledge institutions means less spending on social development, such as youth unemployment and poverty reduction. The challenge, therefore, is how to strike the right balance when allocating government funds to different priorities in Egypt. The study thus provides implications for investment for the case of Egypt, mainly the potential role of international institutions in promoting the absorption capacity, for example by learning from specific past EIB projects that address the identified absorption capacity bottlenecks.

Our results in Sections 3-4 are consistent with the stylized facts in the MENA literature regarding the impediment factors hampering the transfer of knowledge in the MENA region. Our results in Sections 3-4 are also consistent with the stylized facts in the international literature regarding the interaction and linkage between the different knowledge transfer channels as discussed in Section 2. One interesting element in our study is that we present a systematic framework for the factors enable/impede knowledge transfer in Egypt/MENA region. The major policy implication from our findings is that in the MENA region knowledge transfer is facilitated by supporting the linkages between the different knowledge transfer channels within this systematic framework. Knowledge transfer through utilization of FDI is facilitated by the sound institutions for the provision of sufficiently qualified labour, ICT infrastructure, opening up to international trade, good university-industry cooperation, R&D and capacity for innovation. Knowledge transfer through utilization of international trade is facilitated by the sound institutions for the provision of sufficiently qualified labour and ICT infrastructure. Finally, knowledge transfer through utilization of human capital and ICT is facilitated by supporting the complementary relationship between them.

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